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ABSTRACT

The principal objective of this report, the last in a series of three, was to develop and determine cost effectiveness of alternate plans for an effective telecommunications capability through 1975 for the State of Illinois. The State is advised to contract with communications consultants to help it save money on its telephone bill. It is also advised to set up a management organization to integrate its telecommunications facilities. Computerization of portions of the management function is recommended. Nine telecommunication approaches that the State may take are considered; of these, five are costed in detail and are the basis for the development of seven competing telecommunications plans. The highest cost plan is 35 percent higher in cost than the lowest cost system; but cost is not thought to be the only consideration. It is concluded that although the state-owned and leased administrative networks are at least 45 percent more expensive than the common carrier network, they provide greater reliability and survivability. It is recommended that the State should buy more equipment and use the new frequencies, but that no extensive replacement of equipment should be made at this time. Appendices include extracts from legislation setting up telecommunication management organizations. A glossary is given. (MF)

ED0 44046

State of Illinois

ILLINOIS TELECOMMUNICATIONS COMMISSION

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
OFFICE OF EDUCATION

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REPORT C: FINAL REPORT

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SDC

February 15, 1969

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REPORT C: FINAL REPORT

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*Drs. Erickson and Livingston resigned from the Commission in December 1968.
Mr. Heineman resigned from the Commission in January 1969.

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PREFACE

This document is the final report in a series of three reports to the Illinois Telecommunications Commission. For the convenience of the reader who does not have copies of the first two reports, their Summaries have been reproduced on the following pages, preceding the Summary of this document, "Telecommunications Study for the State of Illinois, Report C: Final Report."

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SUMMARY OF REPORT A: INVENTORY OF FACILITIES

The Illinois Telecommunications Commission (ITC), created by Act of the 75th Illinois General Assembly, contracted with the System Development Corporation (SDC) for a comprehensive study of Illinois' telecommunications capability. This report is in fulfillment of the first of 3 study objectives, i.e., to produce a complete inventory of present State telecommunications services and determine their capacity for growth.

Data were gathered from personal interviews, questionnaires, computer magnetic tapes, printouts from the Secretary of State and the Illinois Bell Telephone Company, and printed material and graphics from many sources.

The report is presented in 5 parts; 1) Introduction, 2) Inventory by Agency, 3) Intercity Networks and Common Facilities, 4) Civil Defense Telecommunications, and 5) Educational Television and Radio. A glossary of technical terms is given in the Introduction, and detailed inventory listings and calculations are presented in appendices.

Individual Agency Inventories (Part Two) presents descriptions of the organization and function of 62 State entities. It lists approximate numbers of employees, describes their use of telephone and radio facilities, and gives estimated investment value of State-owned facilities and the annual costs for telephone services and radio maintenance. Adjusted total costs for telephone service, exclusive of dedicated intercity facilities exceeds $8,550,000 per annum. Intercity wire services account for $500,000 more. Estimated total replacement value of radio facilities is about $4,606,000 , and the annual maintenance bill for them is close to $360,000.

Intercity Networks and Common Facilities (Part Three) is divided into Wire and Radio sections. Under the heading Wire Networks, the Springfield

Centrex system and the Illinois Building PABX are discussed as facilities common to many users. Springfield Centrex has about 3,200 subscribers with an annual billing of about $1,380,000. The Illinois Building PABX serves 1,100 subscribers at a cost of about $360,000 per annum. Both facilities are presently adequate for their handling of local calls but have inadequate numbers of dedicated lines to provide good long distance service. Also discussed under Wire Networks are the intercity facilities, consisting of 77 foreign exchange lines, 88 tie lines, 46 off-premise stations, and 5 private lines. These lines are almost all charged under the low Telpak rate. Annual costs for these 216 dedicated lines, representing 23,000 circuit miles, are about $210,000. There are also 36 WATS lines at an annual cost of about $248,000. All of these lines were found to be overloaded with resulting poor service to State users. Analysis showed that a good grade-of-service could be obtained with the amount of traffic presently being handled, only by adding many more lines. The State Police LETS Teletype network costs about $42,000 per annum.

Under the heading Radio Networks, the radio facilities of the 12 State agencies having such facilities are discussed. There are 2 large users of radio, the State Police and the Division of Highways, and 2 medium users, the Departments of Mental Health and Conservation. The other 8 agencies have relatively little radio equipment and consequently, a small investment. Radio equipment in the State consists of:

2,731	mobile units
276	base stations
9	repeaters
32	microwave terminals
72	antenna towers

Replacement value of the radio systems was believed to offer the most meaningful way of assessing capital investment. Estimated replacement value for these equipments and miscellaneous hardware is somewhat over $4.6 million.

Maintenance costs have been estimated to be about $360,000 annually. Overcrowded networks and insufficient channel capacities are the principal factors inhibiting future growth of the radio systems. Most networks already have more mobiles than is advisable for good operations. All users are experiencing the effects of overcrowding of the radio spectrum. It appears that a solution to the problem must be made on the national, rather than at the State or local, level.

Civil Defense Telecommunications (Part Four) is concerned with those civil defense functions that transcend agency lines. The assignments of the State agencies having civil defense responsibilities are based on the State Emergency Preparedness and the Disaster Plans. The State Emergency Operating Center (EOC) is presently connected to the 10 Mutual Aid Area (MAA) EOCs by telephone and to Region 4 Civil Defense Headquarters by radio link. A radio backup network is now being implemented to supplement the MAA telephone network. Supplemental communications are 1) National Communications System I (NACOM I), a Federally sponsored telephone and teletype circuit between the State EOC and Region 4; 2) National Warning System (NAWAS), a Federal private line system to pass warning messages down from 3 National Warning Centers; 3) NACOM II, a Federal multichannel radio backup for NACOM I having a capability for voice, teletypewriter and manual telegraph; 4) Radio Amateur Civil Emergency Service (RACES) base station installations which have been approved for all MAA's; the Northeast MAA base station is presently operational.

Requirements for the immediate future are: 1) to complete the radio network linking the State EOC with the MAA EOC's, 2) to install base stations in the State EOC to net with the State Police, Division of Highways, and the National Guard during emergencies, 3) to connect the EOC to radio station WTAX (AM-FM) in Springfield for entry into the Emergency Broadcast System, 4) to effect wider distribution of radio warning receivers among State agencies, and 5) to integrate the EOC intercom with NACOM I.

Educational Radio and Television Telecommunications (Part Five) inventory data are based on inputs from 40 radio-TV installations within the State. Three Instructional Television Fixed Service (ITFS) systems are operating at Bradley University, New Trier Township and Sterling Township. There are 12 CCTV systems in operation throughout the State; 9 function as intra-institutional communication systems and 3 distribute programs to a number of schools. Most of them are under the auspices of institutions of higher learning. More than 20 educational radio stations operate in the State though information for this report was available on only 15, of which 60 percent are associated with institutions of higher learning. Programming emphasis is on community service.

In all, 30 institutions of higher learning have entered or intend to enter the ETV field. A large number of students received instructional TV (ITV) signals from Midwest Program on Airborne Televised Instruction (MPATI) which is now defunct. Less than one-third of the pupils in the State receive any form of ITV, though both TV and radio coverage tend to be concentrated in areas of higher population. Capital investment in broadcast ETV facilities for the 1964-1968 time period are estimated at about $5.3 million. Current annual operating costs run around $3 million. Capital costs for ITFS-CCTV for the same period are around $1.35 million with annual operating costs estimated at somewhat over $210,000. ITV costs per pupil have been about $3.92 per year. Radio capital costs for 7 out of 15 stations are about $305,000 and operating costs run about $320,000 per annum. It was concluded that: 1) Some form of educational communications is available in almost every area of the State, 2) less than 10 percent of ETV programming is locally produced, 3) broadcast compatible video tape recorders are generally available, 4) production facilities are adequate for current programming, 5) ITFS-CCTV shows the greatest investment increase, 6) a replacement for MPATI needs to be found to maintain the former level of ITV service, 7) a continuing interest in educational communications is indicated, and though system use is now at a low level, it is predicted by practitioners in the field that capacities of existing systems will be strained in the near future.

SUMMARY OF REPORT B: 1975 REQUIREMENTS

This is the second of three reports to be submitted to the Illinois Telecommunications Commission in fulfillment of a contract with the System Development Corporation for a comprehensive study of telecommunications capabilities in Illinois. Report A: Inventory of Facilities was presented to the Commission on September 3, 1968. That document contained a comprehensive inventory of present State telecommunications facilities and costs.

This report, Report B, proceeds from that point to project State telecommunications requirements through 1975. To present these findings in orderly and logical fashion, the report is organized into five Parts: Introduction, Agency Requirements, Intercity Networks and Common Facilities, Civil Defense, and Educational Broadcasting. Appendices containing supplementary material are also provided.

The Introduction includes background on the overall study, a statement of the objectives in Report B, and a summary of the study approach. Findings are based on data from a number of sources, the most important of which are questionnaires returned by agency representatives and follow-up interviews with selected agency spokesmen. These data have been adjusted by the inclusion of values for major external influences to provide the 1975 projections offered in this report. External influences included future trends in overall State employment, past and future budget experience, enrollments in higher education, and patterns of growth and distribution for the State's population.

Part One presents a general overview of population prospects through 1975 for Illinois. This material is included as background information within which State telecommunications requirements estimates may be compared and evaluated. Major demographic trends considered are general increase, age-group composition, geographical distribution, and regional growth differentials.

Part Two identifies 22 State agencies as the major growth agencies through 1975 and projects their telecommunications requirements. Projections are calculated from the average annual rates of change (by agency) in number of employees, operating budgets, and telephone and telegraph contracted services. These findings are adjusted by the inclusion of questionnaire data.

Overall statewide projections are also included. For example, full time State employment is estimated to expand by about 44 percent through 1975, while the annual operating budget for State government will rise some 54 percent. That portion of the budget reserved for telephone and telegraph contracted services is expected to go up about 77 percent, and annual State expenditures for all local and long distance services are projected to increase to more than $16.5 million, a gain of 83 percent over the 1968 total.

Although Part Two documents an increasing need among State agencies for such specialized communications services as data networks, the text makes it clear that local telephone expenditures will remain the major telecommunications cost item through 1975.

Intercity Networks and Common Facilities (Part Three) is divided into Wire and Radio sections. Under the heading of Wire Facilities, 23 intercity corridors are analyzed on the basis of current and future volumes of voice traffic. These corridors represent 86 percent of the total current intercity voice traffic. The Springfield-Chicago corridor is identified as the number one traffic path, both currently and through 1975, because of its general use by virtually all units of State Government. Traffic through this corridor is projected to double by 1975.

The 23 corridors are ranked by both current and projected 1975 volume. Overall voice requirements for the 23 corridors are projected to rise about 92 percent by 1975. A major factor in the projected increase is the need imposed by higher education. Annual costs of this traffic will approach $2.2 million, about one-half of which will represent long distance charges.

Data transmission is identified as a possible major influence on future telecommunications facilities and expenditures. Data systems planned by nine State agencies are discussed, and the locations of proposed remote terminals are tabulated to suggest the scope and impact that planned data networks may have in intercity traffic.

The radio requirements section presents 1975 projections as augmentations of present facilities operated by five large State agencies and six of the State's senior colleges. This group currently accounts for some 99 percent of the State's radio inventory, and 1975 requirements call for about 560 additional mobile units, 33 base stations, and 40 portable units. This expansion is estimated to add about $996,000 to the State's investment in radio.

Part Four discusses Illinois Civil Defense Requirements through 1975 in respect to the nationwide civil defense program. State civil defense communications requirements are identified in terms of what must be done (and by whom) to meet both upward and downward functional requirements.

In addition to requirements cited in Report A, three immediate and vital telecommunications requirements are identified and discussed in terms of availability, survivability, and network potential. These three requirements are: (1) a system for reliable contact with major functional agencies that have assignments such as rescue and radiological monitoring, (2) a secondary system of dedicated links to the other State and interfacing agencies, (3) a shelter communications system. The advantages and disadvantages of using radio or telephone facilities to meet these needs are discussed.

Civil defense telecommunications requirements through 1975 will continue to be those considered necessary by the Director to meet the objectives of the Federal program. Based on Federal research and policy studies, there is little indication that stated needs will shift significantly over the coming seven years.

Part Five combines the findings of survey questionnaires, interviews with members of the Illinois Telecommunications Commission, and seminars among nationally recognized authorities on educational broadcasting to project expanded requirements of educational broadcasting services, principally for TV, over the next several years.

The State's operating and facilities plans include an intention to concentrate on the UHF spectrum for increased community services in the instructional television area. Both Instructional Television Fixed Service (ITFS) and closed circuit television (CCTV), principally internal systems, are identified as the areas of greatest expansion in services and capacity through 1975. Two new educational radio facilities are expected, but beyond these additions, educational radio requirements are expected to remain little changed through 1975.

Capital costs for ITFS-CCTV are predicted to be 50 percent greater than for broadcast TV between 1969-71. While no growth in ITFS is expected from 1972 to 1975, costs for CCTV are expected to be four times as large as broadcast television costs. Expansion of the Office of the Superintendent of Public Instruction into educational TV production and services (beginning 1968-69) will provide some $250,000 annually for programming after 1970.

Noncommercial radio and television system planning for the State is indicated as requiring a plan to provide both a mass communication capability and a localized or individualized capability. These twin capabilities will require supervision at the State level to achieve economy, efficiency and effectiveness.

SUMMARY OF REPORT C: FINAL REPORT

Part One: Introduction lists the milestone events since the Illinois Telecommunication Commission (ITC) contracted with the System Development Corporation (SDC) on March 4, 1968 to study the telecommunications capability of the State. This is the Final Report of the study, the principal objectives of which were to: 1) produce an inventory of present telecommunications requirements, 2) project telecommunications requirements to 1975, and 3) develop and determine cost effectiveness of alternative plans for an effective telecommunications capability through 1975.

Report A: Inventory of Facilities, published September 3, 1968 fulfilled the first objective. Report B: 1975 Requirements fulfilled the second. This Final Report fulfills the third objective.

The report is presented in six (6) parts: 1) Introduction, 2) Cost Reduction, 3) Telecommunications Management, 4) Approaches Considered, 5) Cost Effectiveness Analysis, and 6) Conclusions and Recommendations.

Part Two: Cost Reduction introduces a new approach to saving on common carrier telecommunications costs. Local telephone costs at $7.8 million are shown to represent over 87 percent of the total telephone bill compared to 13 percent for intercity telephone costs. Experience of SDC's communications consultants is that savings of from 10 to 25 percent can usually be saved on large telephone accounts. Most fruitful areas of saving are service disconnects during vacation periods, removal of unneeded push button equipment and unused dial switchboard equipment, correction of billing discrepancies and proper trunking to reduce excessive message unit costs. The State is advised to take advantage of these cost reduction possibilities by contracting with expert communications consultants who specialize in this type of savings.

Part Three: Telecommunications Management discusses the necessity for the State to set up a management organization to integrate the State's telecommunications facilities. The need for a policy-making body at the highest level is recognized as well as an operations organization to handle the daily chores of telecommunications management. Similar organizations in California, Colorado, Idaho, Iowa, Massachusetts, Nebraska, North and South Carolina, and Pennsylvania are explained and extracts from the legislation setting up their telecommunications management organizations are presented. A typical operations division with four units, Engineering, Operations, Purchasing, and Administrative is described with recommendations on how Illinois should coordinate operations and implement the management structure. Computerization of portions of the management function is recommended.

Part Four: Approaches Considered defines the channel requirements for telephone, data, radio, civil defense, and ETV. The monthly volume of telephone calls increase 85 percent from 182,000 in 1968 to 337,000 in 1975. Land mobile radio units increase from 3,000 to 3,700 over the same period.

Nine approaches were considered.

	Annual Cost
• Common Carrier (POTS[*]) administrative network	$ 906,880
• Common Carrier ETV network	850,968
• State-owned ETV network	829,307
• State-owned administrative network	1,476,815
• State-owned combination ETV and administrative network	2,150,854
• Land mobile radio network	---
• A "minimum cost" microwave approach to intercity service	---
• Communication satellites	---
• Community antenna television	---

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[*] Plain Old Telephone Service

The first five networks were costed in detail and found suitable for inclusion in the cost-effectiveness analysis in Part Five.

Land mobile radio was discussed and costed but due to its unique requirements was not included in the cost-effectiveness study.

The "minimum cost" microwave approach turned out upon analysis to be not minimum cost so was dropped from further consideration.

The Satellite and CATV ETV networks were found to be unsuitable for the State at this time due to excessive cost.

Part Five: Cost Effectiveness Analysis combines the first five networks described in Part Four into seven competing telecommunications plans, each of which meets the ETV and administrative network requirements.

	Annual Cost
● POTS administrative network + leased ETV network	$ 1,728,547
● POTS administrative network + State-owned ETV network	1,736,187
● POTS administrative network + common carrier ETV network	1,757,848
● Leased combined administrative and ETV network	2,112,602
● State-owned combined administrative and ETV network	2,150,854
● Leased administrative network + common carrier ETV network	2,291,035
● State-owned administrative network + common carrier ETV network	2,327,783

The highest cost system above is 35 percent higher in cost than the lowest cost system.

It was found that cost alone could not be used to select the best system for the State so a "decision model" is presented to aid in making the choice. It shows that if cost is to be the most important criterion then the choice of a system will be among the first three of the above plans, with the choice among the three depending on subjective criteria other than cost.

The model also shows that if the State is willing to pay a 20 percent premium ($354,000 per annum) for high reliability and survivability of the State Police, Highways, and Civil Defense priority circuits, then the choice is between Plans 4 and 5 above.

As only the variable cost figures were used in the cost-effectiveness comparisons, it gives a misleading idea of the total costs to the State. To rectify this, total costs are developed for the above plans which also include the costs for the 11 proposed UHF ETV transmitters, the local telephone service and the land mobile maintenance. These annual costs are:

	Annual Cost
• POTS administrative network + leased ETV network	$ 19,412,089
• POTS administrative network + State-owned ETV network	19,457,466
• POTS administrative network + common carrier ETV network	19,479,127
• Leased combined administrative and ETV network	19,796,144
• State-owned combined administrative and ETV network	19,872,133
• Leased administrative network + common carrier ETV network	20,012,314
• State-owned administrative network + common carrier ETV network	20,049,062

A two-step phased implementation plan was investigated based on first interconnecting only the existing five ETV broadcast sites with UI and SIU.

The State can save between $500,000 and $600,000 per annum by installing a limited network and another $1,700,000 per annum by not installing the 11 new UHF ETV transmitters. This is a total "saving" of about $2,300,000 annually but is actually not a saving as the Phase I system does not meet the State's ETV requirements and actually offers very little more capability than now exits.

Potential sources of federal agency matching funds to assist the State in implementation of telecommunications systems are listed. The most promising are Transportation; Justice; Civil Defense; and Health, Education, and Welfare. It is shown that no agency will match funds for a complete telecommunications system, but only on a portion of the system that meets precise requirements for funding.

Part Six: Conclusions and Recommendations list ten principal conclusions that resulted from the study, seven of which are accompanied with recommendations.

- The local telephone bill is the largest telecommunications expense of the State. Substantial savings may be expected if expert help is hired to maximize efficiency and minimize waste in the State's telecommunications plant.
- A telecommunications management capability is needed by the State. A telecommunications advisory committee and a management division should be created to administer the telecommunications facilities of the State.
- FCC rules will probably allow interconnection of a State-owned network with the common carrier telephone plant in the near future, although this depends on the final outcome of the Carterfone case which is still in litigation.
- Assuming that the Carterfone decision will stand, it is legally, technically, and economically feasible for the State to operate a private telecommunications system to carry its ETV and State agency voice and data traffic.

- Congestion in the land mobile radio network will probably be relieved temporarily by the FCC with new frequencies in the lower UHF television band. The State should buy more equipment and use the new frequencies, but no extensive replacement of equipment should be made until the newer band-conserving equipment now being developed by the military becomes available after 1975.
- Due to the wide bandwidths required for television channels, the only part of the spectrum that is feasible for a multi-channel State-owned or leased ETV network is in the 12-GHz band.
- Cost differences among ETV networks 1) common carrier, 2) State-owned and, 3) leased are negligible. Educational authorities should refine their long range ETV requirements to see if these may provide decision criteria.
- The State-owned and leased administrative networks are at least 45 percent more expensive than the common carrier network, but provide greater reliability and survivability because they are independent systems with the common carrier system as back-up. The State must decide if the added reliability and survivability are worth the extra cost.
- If the State decides the State-owned or leased administrative network is necessary to provide high reliability and survivability, then there are cost advantages in having the ETV network also State-owned or leased. In this case, the State should purchase or lease a combined microwave network at a saving of about $130,000 annually over having them separately built and financed.
- Federal agencies cannot be depended upon to fund a large part of an ETV and administrative network. The State should try for all Federal funds to which it is entitled but also be prepared to pay the major part of the costs out of State funds. Also the State should not allow Federal qualifying criteria to jeopardize State requirements or run State costs above the Federal matching funds received.

PART ONE: INTRODUCTION

Background

The Illinois Telecommunications Commission (ITC)* contracted with the System Development Corporation (SDC) on March 4, 1968 to study the telecommunications capability of the State of Illinois. The Study was solicited by the ITC to assist it in the development of a long-range plan for an effective and efficient electronic telecommunications system for the State. During the life of the contract the following milestone events have occurred.

- March 19, 1968--SDC opened an office in Springfield, Illinois, to administer the collection of telecommunication inventory data.
- May 8, 1968--First oral presentation to the ITC was made by SDC. This included a review of the data gathering effort in Springfield and an outline of SDC's plan for carrying out the complete study.
- June 14, 1968--SDC completed the data collection effort in Illinois, closed the Springfield office and moved operations to the home office of SDC in Santa Monica, California.
- September 3, 1968--SDC published Report A: Inventory of Facilities, TM-4029/000/00.
- September 11, 1968--The second oral presentation was made to the ITC by SDC. It consisted of a review of Report A and a discussion of plans and preliminary results of the studies leading to Reports B and C.

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* Created by Act of the 75th Illinois General Assembly (House Bill No. 2138, June 17, 1967).

- September 30, 1968--SDC published Report B: 1975 Requirements. TM-4029/001/00.

- October 9, 1968--The third oral presentation was made by SDC to the ITC. This was for the purpose of reviewing Report B and receiving guidance from the ITC for the final phase of the study leading to this final report (Report C).

The submission of this final report signifies the completion of the Illinois Telecommunications Study.

Objectives

Three principal objectives of the study were:

- To produce a complete inventory of the present telecommunications facilities of the State and to determine their capacity for growth.

- To analyze the trends of telecommunications use and determine the telecommunications requirements of the State projected to 1975.

- To develop and determine the cost-effectiveness of short- and long-range plans for the growth of a telecommunications capability adequate for Educational Television (ETV), Civil Defense, normal priority and traffic projected to 1975.

Report A: Inventory of Facilities and Report B: 1975 Requirements met the first two objectives. This report fulfills the third objective. The intention of this third part of the study has been to consider the realities of the fiscal and political situation in the State and to propose workable rather than perfectionist solutions to the telecommunications problems. Cognizance is taken of the fact that State and local governments do not have the funds to support research and development of telecommunications systems without Federal assistance. Recommended systems must be capable of being implemented with off-the-shelf hardware items. Where there is doubt that the technology is developing fast enough to allow optimum solutions to problems to be available by 1975, the State is advised not to make major investments in new hardware until such solutions do become available. A case in point is that of land mobile radio. It is probable that the new frequencies made available by the FCC for this service are only a stop-gap solution. Until civilian hardware and FCC approval become available for utilizing some of the bandwidth conserving techniques that are being developed by the Military, it is best to refrain from making a major commitment to completely new hardware which offers only a temporary solution.

Above all, the objective is to provide meaningful guidance to the Commission in choosing a course of action offering the highest probability of meeting the telecommunications requirements of the State at minimum cost. This is to be achieved despite a proliferation of technological alternatives, the uncertainty of the rapidly changing Federal regulatory environment, and the vagaries of Federal-State assistance funding programs.

Approach

SDC's approach to the study has been 1) to obtain as much information as possible on the present telecommunications facilities of the State, 2) to derive and crosscheck from alternative sources the projected telecommunications requirements through 1975, and 3) to develop, cost, and compare the most promising plans for telecommunications development through the year 1975.

Report A: Inventory

In the inventory effort, culminating in Report A, SDC obtained data from many sources, the principal ones being:

- 117 personal interviews with State personnel.
- 600 questionnaires completed by State employees.
- Printed materials from State agencies.
- Computer printouts and magnetic tapes on the Springfield Centrex from the Secretary of State.
- Computer printouts and other data on the State telephone facilities from the Illinois Bell Telephone Company (IBT).
- Other sources cited separately in Report A.

Extensive cross checking among sources was used to verify the accuracy of the accepted data.

Report B: 1975 Requirements

In defining the 1975 requirements as specified in Report B, selected parts of the inventory data collected for Report A were used, augmented by external source data such as Census Bureau growth estimates for Illinois and technological changes affecting the operations and growth of State agencies. Principal indices used for extrapolating telecommunications requirements through 1975 were:

- Population growth, composition, and distribution.

- State employment historical trends.
- Expansion plans of State agencies.
- State budget allocations--past history and projected future plans.

Report C: Final Report

Using data from Reports A and B, feasible alternative plans were developed for implementation of a State telecommunications facility. These plans were based on the expected development of technology through 1975. The plans that met minimum effectiveness criteria were costed and compared. Limitations of the various plans are described and, in some cases, procurement strategies based on the expected development of superior telecommunications hardware in the post 1975 period are presented. Four basic alternative plans for handling voice and data traffic as specified in the work statement (although later modified, womewhat, in discussions between the ITC and SDC) were described and costed: These were:

- Augmentation of current facilities through 1975.
- Common Carrier plan whereby all telecommunications services are provided by telephone company facilities.
- State-owned plan in which all telecommunications services, except local telephones, are owned by the State.
- State-leased plan whereby all telephone facilities except local telephones are leased from a non-common carrier company.

There were three ETV network options that were considered with each of the four administrative networks, making 12 possible combinations in all. These were:

1. A State-Purchased Educational Television system.

2. A State-Leased Educational Television system.

3. A Common Carrier Educational Television system.

Some combinations were not feasible and were discarded after a minimum of discussion. An example is the Common Carrier plan which was impossible for SDC to cost as this plan is being prepared by IBT. Its costs will probably be dependent upon "special" tariffs applied for by the telephone company and not disclosed to SDC. It is also not feasible to combine a State-owned administrative network with a Leased ETV network, and vice versa. These plans were discussed, but were not costed and compared with other plans.

The twelve considered plans can be represented by the following matrix:

ADMINISTRATIVE NETWORK OPTIONS	ETV NETWORK OPTIONS		
	PURCHASE	LEASE	COMMON CARRIER
Augmentation to 1975	(X)	(X)	(X)
Common Carrier	-	-	-
Purchased	(X)	-	(X)
Leased	-	(X)	(X)

Those combinations indicated by an (X) were costed in Part Four and analyzed in Part Five. The remaining combinations were discussed but not costed.

In addition, CATV and Satellite distribution plans have been discussed as alternatives for the distribution of the administrative and ETV traffic. Where possible, representative costs for these plans are presented.

Each of the alternative plans has been designed to meet the minimum requirements for the following classes of traffic:

- Educational Television and Radio
- Civil Defense and Emergency Voice
- Normal Voice and Data
- Priority Voice and Data
- Land Mobile Radio

Organization of Report

Part One contains the introductory material that describes the background, objectives, approach, and the organization of Report C. It also recapitulates some of the introductory material of Reports A and B to lay a foundation for the following parts.

Part Two presents a different position on cost reduction than had been originally anticipated in the scope of the Work Statement for this study. In this sense, it represents a bonus to the State as it indicates that large savings may be made on the State's telecommunications services over and above the savings that will accrue from increased efficiency, centralized management and integration of multi-agency requirements. And, these savings are possible without detriment to any of the services presently in use. Realization of these savings will require additional outside professional assistance and will only be effective in the long run if the State adopts a telecommunications management organization of the type discussed in Part Three.

Part Three is a discussion of the concept of centralized management of the State's telecommunications facilities. It demonstrates the need for such centralization and describes and costs the typical organizational elements needed to function properly. It describes computational and analytical tools that would be useful in carrying out the duties of such an organization and the types of skills that will be needed in the hired and consultant personnel retained to administer the centralized functions. Examples of this type of operation in other States and samples of their enabling legislation are presented.

Part Four updates the telecommunications requirements for ETV, Civil Defense, State normal and priority traffic and the land mobile radio network with new information that has become available since publication of Report B. It develops the four alternative plans and the three ETV options to these plans that represent feasible solutions to the Illinois telecommunications problems. Land mobile radio operations are a different class of telecommunications than the point-to-point networks described in the alternative plans and options and therefore they have been analyzed separately.

Part Five develops the annual costs and effectiveness criteria for those configurations that are feasible and are capable of being costed. The cost effectiveness analysis is of the fixed performance type as opposed to the fixed cost type, thus making cost the principal criterion for selecting one plan over another.

Part Six contains the conclusions and recommendations.

PART II: COST REDUCTION

In support of the Commission's goal of developing efficient telecommunications, one important aim of this study has been to identify ways in which the costs of telecommunications services to the State could be reduced without reducing their quality or quantity. At the start of the study it had been tacitly assumed that the greatest savings could be realized by increasing the efficiency of handling the intercity telephone and data traffic. The ITC statement of work and the SDC proposal both placed emphasis on the need to consider alternative plans for handling the intercity traffic, and a large part of this report is, therefore, concerned with these comparisons.

Savings can be made in this area, but SDC's analysis of the inventory data in Report A showed that realizable amounts would probably fall far short of the savings that everyone had expected could be made. To be specific, Report A indicates that out of a total average yearly expenditure for all telephone services of about $9,000,000, around $450,000 was spent for intercity trunking and WATS lines, and $700,000 was spent for toll service. This represents about $1,150,000 total spent on long distance services for the year. This amount is less than 13 percent of the total yearly outlay for telephone services. The amount spent for local telephone services (advance rentals and message unit charges) is more than $7,850,000 per annum, or over 87 percent of the total telephone bill.

Common sense would indicate that the most fruitful area to search for potential savings would be in the area of largest cost, not the intercity services. A small percentage saving in local telephone costs would exceed any savings that could possibly be made in the long distance services. For example, a mere five percent saving in the local services bill would amount to over $390,000 per year. It would take a 34 percent saving in the cost of long distance services to match this kind of savings. Thus, there is a seven-to-one advantage in seeking savings in the bill for local telephone services over the intercity services. This part of the report is therefore devoted to a discussion of how the State can effect large savings in the costs for local telephone services.

One approach for effecting savings in the local area was recognized early in the study. It consists of increasing the efficiency of use of local telephone facilities by standardizing the criteria under which expensive optional equipment such as key systems and call directors would be authorized for use. But this approach was considered to be beyond the scope of this study because:

- There is, as yet, no central telecommunications management authority established in Illinois to furnish the control to make such a system work.
- This type of analysis was not called for in the work statement.

Cognizance was taken of this situation in Report A where a distinction was recognized between specifying requirements derived from traffic loading statistics and requirements based upon efficient use by an agency. Although detailed savings in this area are not specified in this study, it still remains a fruitful area for potential savings. With the proper State organization designated to promulgate and enforce rules specifying efficient use of all telecommunications facilities, large savings should be realized in the future by the State.

This and other aspects of the subject of telecommunications management is covered in Part Three of this report.

Another approach to reducing costs that was considered but also discarded was the acquisition of State-owned telephone facilities in the local area. A solution of this type was specified in the Work Statement as a possible means of reducing costs of the intercity telecommunications services. The two areas are quite different, however, and it is generally recognized that the State could not feasibly compete with the common carriers in providing the fast, efficient, complex local services to which all Americans have become accustomed.

Still, intrigued by the large savings potential offered by the local service portion of the yearly telephone bill, SDC decided to dig deeper for possible ways to increase savings. We feel that our efforts were well rewarded and that SDC can now suggest ways for the State to save substantial sums of money on its local telephone bill without suffering any impairment of these services.

This is not an indictment of the policies or practices of the common carriers in Illinois, it is simply a recognition that centralized telecommunications management on the part of the State is necessary if all opportunities for savings are to be exploited.

Part of the monthly charge for services is a "rental" for the equipment being used to furnish these services. These rental fees have been incorporated into telephone tariffs but often the fee charged may bear little relationship to the value of the service rendered or to the cost of the service to the telephone company. Some services are just not worth the price charged and they should be eliminated. The Telecommunications Division, proposed in Part III of this report, should represent the State at rate hearings held by the carriers before the Illinois Commerce Commission in order to reduce the rates for desired services that they feel are too costly.

Due to the size and complexity of most government and large commercial telephone installations, it often becomes next to impossible to keep track of all of the extra items that are being charged for on a monthly basis, particularly where many of them are based on hidden internal switching equipment. This is especially true in Illinois, where the State deals with 60 common carriers in 1,400 separate billing accounts. Those having responsibility for paying the telephone bills find that the information needed to properly check the charges is not readily available, and many times they do not possess the skills for a proper evaluation of the charges. Although this point was not investigated in Illinois, we have often found elsewhere that even telephone sales representatives do not have the knowledge and skills necessary to properly analyze a complex telephone installation. Some of the areas that are particularly susceptible to mistakes in billing and therefore amenable to high potential saving are discussed below.

Disconnection of Service

One of the least known telephone company service offerings is the option to temporarily, or permanently, disconnect telephone service during periods of reduced business activity. The disconnected service usually receives a 50 percent (sometimes 100 percent) savings during the period when service is disconnected, and there are usually nominal or no disconnect or reconnect costs. Even for permanent disconnects where there are disconnect and reconnect charges it is usually possible to save more than enough on the disconnected service to pay for these extra charges and still show a good savings. The principal beneficiaries of this savings method are the schools, particularly the institutions of higher learning, since they are heavy users and their activity declines to a fraction of the normal activity during the summer vacation period. For example, the regular enrollment of 32,000 at the University of Illinois drops to 10,000 students during the summer. It is usually possible in these institutions to disconnect a large part of the normal services during this period without suffering any degradation of service. A spot check of the telephone bills for the University of Illinois (UI) and Southern Illinois University (SIU) shows the following:

MONTH 1968	MONTHLY TELEPHONE BILL	
	SIU	UI
April	$ 29,615	$ 90,597
May	29,710	90,597
June	27,713	79,431
July	30,109	74,539
August	31,894	74,907
September	31,975	91,756

It can be seen that UI did disconnect some telephones during the summer as the monthly bills indicate a decrease of about $11,000 during June and a decrease of about $16,000 during July and August. However, this saving to the State is more apparent than real, since almost all of the discontinued service is in the residence halls. Normally, these accommodate around 10,500 students who are charged by the School for the service when they are in residence. Apparently SIU is not taking advantage of the temporary suspension of service offered in the tariffs. Service is furnished to UI by Illinois Bell Telephone Company, and SIU is serviced by the General Telephone Company. Both of these companies have filed tariffs which allow a 50 percent reduction in the charges for the suspended service during periods of complete or partial temporary suspension of service. Illinois Bell has a minimum suspension period of two months and General Telephone Company has a minimum period of one month. There is a nominal, nonrecurring setting-up charge of $3.00 per customer order. The State is missing a potential saving of many thousands of dollars on this one item alone.

Push Button Equipment

Push button (key systems) equipment charges in large telephone installations usually represent a major item in the fixed monthly telephone bill. Experience has shown, however, that the majority of key systems have some features that are unnecessary to the conduct of the business of the department to which they are assigned. For example, all of the telephones in an office may not need to be included in the key system; intercom capability may not be necessary if all telephones are in the same office; the winking hold feature may be unnecessary and redundant. This unnecessary capability may come about for several reasons, e.g., the equipment may have been necessary when first installed, but time and successive moves and reorganizations may have rendered the original key network no longer optimum for the organization. Key systems are widely used in Illinois; the Springfield Centrex alone has 718 listed in IBT's February 1968 bill. Since some of these cost over $300 per month, the opportunities for savings are obvious.

Dial Switchboard Equipment

Throughout the country, many users of dial automatic equipment are paying for excessive backup switching equipment. In installations investigated elsewhere, many of the selectors, line finders, and connectors being rented from the various telephone companies on a monthly basis have been found to be unnecessary for the efficient handling of calls. If the trend in Illinois is similar to that found in some other States, potential savings in this area can be considerable. The cure is to determine the correct numbers of switching equipment needed and to have the unnecessary equipment disconnected and the charges removed from the monthly bill.

Billing Discrepancies

An independent telephone cost-saving consultant who advised SDC on this part of the study states that many of the large telephone users in California are being billed for telephone service and equipment that are non-existent. It is found that these billing discrepancies are accidental, but nevertheless, they do result in unnecessary extra charges to the telephone user. Where such unjustified charges are discovered, retroactive refunds are obtainable from the telephone company as well as the elimination of these excess charges on all future billings. In some cases, these refunds can amount to a large sum of money. The Long Beach Press Telegram and the Leisure World Foundation of Southern California obtained refunds from the Pacific Telephone Company of about $5,000 each for charges for nonexistent services. One Las Vegas firm obtained a $20,000 refund. Here again, if the same pattern of billing discrepancies becomes evident in Illinois, the State may be able to effect large savings.

Message Unit Costs

It has been found that, in general, 25 to 50 percent of all message unit charges can be eliminated by having employees select proper lines or trunks when placing calls outside their free calling area. By changing the type of lines that are available to the employees, and by conducting an extensive employee education program in the proper use of these lines, large savings can be made. One commercial office alone, Coldwell Banker and Company of Los Angeles, has reduced its headquarters message unit charges by over $500 per month, about a 25 percent saving.

The above examples illustrate but a few of the areas that offer great potential savings to a customer who is willing to do the necessary homework to uncover and correct the errors commonly found in utility bills. Most of the experience to date in correcting overcharges has been the result of studies by communications consultants for private industry, and for a few public school districts and hospitals. Some of the large corporations that have benefited by this service are: Carnation Company, Olivetti Underwood Corporation, General Radio Corporation, Owens Corning Fiberglass, Shell Oil Company, Morton Salt Company, Price Waterhouse Company, Montgomery Ward and Company, General Motors Corporation, Chrysler Corporation, R. H. Macy's, and the Christian Science Monitor. The average savings realized by this method have ranged between 10 and 25 percent of the total telephone bill. If this figure could be applied to the State annual bill for local telephone charges, the savings realized would range between $780,000 and $2,000,000 annually. It may even be that these figures are conservative. It has been estimated that State and local governments are particularly subject to overcharges due to the nature of their business. A large share of the State telephone costs are incurred by schools and hospitals, institutions that, in our experience, seldom examine their bills critically and therefore are uncommonly productive when analyzed for overcharge savings.

In Illinois, the lack of centralized control of telephone usage and billing, makes the problem of effective checking and control almost impossible. There are almost 1,400 separate State telephone accounts made up each month to bill the State for telephone services. The sales representatives of the telephone companies servicing the State are widely scattered geographically, each having jurisdiction over a few of the many State accounts and generally not in close contact with each other. In Springfield, the Office of the Secretary of State has initiated a number of charge revisions based on improper billing and has, in at least one case, obtained a refund of several thousand dollars from the telephone company.

It is true that savings can be achieved in almost any large telephone system. That these savings can be easily achieved by almost any State employee is not necessarily true and can be misleading. It takes a real expert to uncover communications waste within a huge and complex organization such as State Government.

Some of the questions that must be answered by the investigator are:

- How does one spot an erroneous charge?
- How does one apply to the telephone company for a refund?
- How does one check that every item for which the State is billed is actually in use?
- Does the State really need every item for which it is paying?
- Are there less expensive systems which will accomplish the same function for the State but will cost less money?
- Has an objective comparison of all telephone company's tariff offerings for the desired service been made?
- Have the communications being used by the State been tailored to the operation being performed?
- Is a less expensive private system available?
- Is a more efficient private system available?
- How should the State telecommunications regulatory body, the Illinois Commerce Commission, be approached to register complaints and petition for tariff changes?
- How does one effectively participate in rate hearings for reduction in intrastate rates?

- How does one generally control telephone costs?
- How does one master the complex and voluminous telephone tariffs posted with the ICC which are written more for the lawyer and technician than for the layman?

These and many more questions must be answered to obtain the maximum benefit from this service. Business concerns have been increasing their use of independent telephone consultants to help reduce telephone costs and to increase the efficiency of use of the complex equipment of today. It is even more imperative that government bodies which are responsible to the taxpayer exercise the utmost effort to reduce operating costs and increase the efficiency of their operations. This can and should be done as a normal concomitant to the performance of State business.

There are two ways to accomplish this task: 1) hire a telephone expert with the necessary qualifications, or 2) contract with a communications consulting firm to perform the investigation. The latter method would be the best procedure for a government body that does not have the telecommunications functions organized into a centralized body for standardization and control.

On a consulting job of this nature, payment can be made on the basis of a negotiated fixed fee, or the consulting firm may agree to conduct the study for a percentage of the dollar savings realized from the study. The advantage to the State of the latter method of payment is that the State is guaranteed a saving at no cost. On the other hand if the savings effected are large the fee paid to the consultant may be quite large, and the State might do better to pay a flat fee covering the effort expended by the consultants. Whatever the means used to effect an investigation of the telephone bill for potential savings, the State stands to gain considerably.

PART THREE: TELECOMMUNICATIONS MANAGEMENT

Systematic telecommunications management is characterized by its uneven distribution at all levels of government--local, state and Federal. Most state and Federal agencies do not single out telecommunications for special administrative attention, relying instead on individual departments and agencies to manage their own communications affairs. A recent study completed by SDC for the Office of Telecommunications Management of the Federal government disclosed that while pressure is mounting for state and Federal government to provide more telecommunications-oriented services, telecommunications management aspects are either overlooked or included only under general wording in most legislation. The study further showed that Federal and state capabilities to administer telecommunications programs are generally deficient and that information on which to base future telecommunications planning and management is generally inadequate.

These findings are especially relevant because telecommunications activities are today in a period of explosive expansion and change. Technical capabilities such as data transmission and microwave distribution not only promise to add to telecommunications volume, but they also provide the means for many new users to move into telecommunications. Without systematic direction and management, this development will almost certainly lead to the construction of duplicative facilities and deprive the State of the savings realizable through interagency sharing of telecommunications systems. The Illinois State Legislature recognized this clearly in establishing the Illinois Telecommunications Commission. House Bill No. 2138 calls for a long-range plan for telecommunications use and development, especially in the field of educational television.

Illinois is now one of a relatively small handful of states that is concentrating top-level attention on telecommunications development. Research undertaken in preparing this part revealed that no more than 14 states have either begun, or plan to begin, formal telecommunications planning. Of this group, only a few have created advisory groups and government-wide operational or management divisions, the latter empowered to administer state government telecommunications programs from a central office.

The Case for Central Management

Management theory recognizes several acceptable and workable approaches to the administration of large organizations. One of the most familiar, and one well known in the public sector, is the staff-line arrangement where direction and control are exercised from a central authority and flow downward through subordinate echelons. It is typical in state government that authority relationships are articulated formally through written administrative manuals, legislative codes, personnel regulations, and related documents. Virtues of centralization are numerous: intelligent cost control policies through budget control and review; economical purchasing through consolidated buying procedures; establishment of priorities for commonly shared facilities; and concentration of planning responsibility under a single authority.

Another management approach, and one that is particularly associated with education and research, is the decentralized pattern in which line units operate with considerable autonomy. The relationship between the University of Illinois and State government is an example here, as is the independence of medical research units in many large medical teaching complexes. The advantages of this arrangement include separation of academic and political issues and the maintenance of an environment in which specialists can remain free of administrative pressures while concentrating their energies on complex problems.

Presently, Illinois State agencies present a confusing picture in the way they manage their telecommunications activities. Those agencies that do have a telecommunications officer usually include telecommunications responsibilities within a rubric of operational and administrative tasks, thus depriving themselves of fulltime attention to telecommunications. There is also limited funding, shortage of staff, and lack of the specialized skills necessary to cope with modern telecommunications applications and technical changes. At the Statewide level, there is as yet no policy-making board or commission empowered to review telecommunications proposals, conduct studies and research, establish uniform rules and regulations, provide advice and representation before the Federal Communications Commission or the Illinois Commerce Commission, and impart to telecommunications administration the force of executive-level authority. The ITC, although a temporary body, is a meaningful first step in this direction.

The establishment of both a statewide advisory board and a working telecommunications division within an appropriate state agency is an approach that has met with favor in other states. Table 3-1 presents a summary of organizational proposals, both in force and under consideration, in a sample of states now wrestling with the problem of organizing their statewide telecommunications operations. The states offer a variety of management approaches, varying from the comprehensive centralized pattern to the decentralized, the latter usually a de facto arrangement that has evolved. Illinois is included in Table 3-1 for comparison.

State Patterns

California follows a centralized format that includes a 15-member Communications Advisory Board and an operational Communications Division located in the Department of General Services. The Advisory Board consists of representatives of seven State government departments, the Governor's office, local law enforcement, local fire protection, and industry. Among its regular duties, the Board is empowered by statute to "recommend to the appropriate state and

Table 3-1

Summary of State Telecommunications Legislation

STATE	TELECOMMUNICATIONS ADVISORY ORGANIZATION	EDUCATIONAL TV/RADIO ADVISORY ORGANIZATION	TELECOMMUNICATIONS OPERATIONAL UNIT	CIVIL DEFENSE	FUNDING
CALIFORNIA (Enacted 1965)	STATE TELECOMMUNICATIONS ADVISORY BOARD; CREATED BY STATUTE; FIFTEEN MEMBERS SPECIFIED BY STATUTE, 4-YEAR TERMS; PROVIDE ADVICE, POLICY GUIDANCE, AND REPRESENTATION BEFORE THE FCC.	TELEVISION ADVISORY COMMITTEE, EIGHT MEMBERS; PUBLIC SCHOOL INSTRUCTIONAL TV COMMITTEE, 20 MEMBERS.	COMMUNICATIONS DIVISION, DEPT. OF GENERAL SERVICES; AUTHORITY PRESCRIBED IN SECTIONS 4500-4583, STATE ADMINISTRATIVE MANUAL.	DIRECTOR OF DISASTER OFFICE IS A MEMBER OF THE COMMUNICATIONS ADVISORY BOARD.	GENERAL FUND
COLORADO (Enacted 1967)	ETV ONLY	THE COLORADO COMMISSION ON EDUCATIONAL TELEVISION ESTABLISHED BY EXECUTIVE ORDER. COMMISSION COMPOSED OF 7 MEMBERS APPOINTED BY THE GOVERNOR TO: 1) DETERMINE NEEDS, 2) MAKE RECOMMENDATIONS, 3) RECEIVE AND ALLOCATE MONIES TO IMPLEMENT RECOMMENDATIONS, 4) COORDINATE WITH VARIOUS LEVELS OF GOVERNMENT.			PRESENT EXPENDITURES COME FROM THE GOVERNOR'S FUND.
IDAHO (Enacted 1967)	OPERATIONAL DIVISION ONLY, SEE COLUMN 3.		DIVISION OF COMMUNICATIONS, DEPT. OF ADMINISTRATIVE SERVICES; ADMINISTRATOR APPOINTED BY DEPT. DIRECTOR AND APPROVED BY GOVERNOR.		GENERAL FUND
ILLINOIS (Enacted 1967)	ILLINOIS TELECOMMUNICATIONS COMMISSION, CREATED BY STATUTE (H.B. NO. 2130) FOR 2-YEAR PERIOD, 14 MEMBERS. NOW CONDUCTING STUDY OF TELECOMMUNICATIONS REQUIREMENTS TO PROPOSE SHORT- AND LONG-RANGE PROGRAMS.	ITC STUDY TO ANALYZE PROGRAMS IN INSTRUCTION AND PUBLIC TV AND NEED FOR ADDITIONAL TV FACILITIES AT STATE COLLEGES AND UNIVERSITIES.	LEGISLATION BEING PREPARED TO PLACE TELECOMMUNICATIONS RESPONSIBILITIES UNDER DEPT. OF GENERAL SERVICES (EXCEPTING OPERATIONAL REQUIREMENTS).	ITC STUDY TO INCLUDE CIVIL DEFENSE REQUIREMENTS IN THE ITC TELECOMMUNICATIONS STUDY.	APPROPRIATIONS OF $250,000 TO ITC AND $1,467,000 TO THE SUPERINTENDENT OF PUBLIC INSTRUCTION.

*SEE APPENDIX A FOR COPIES OF THE LEGISLATION

Table 3-1
(Continued)

STATE	TELECOMMUNICATIONS ADVISORY ORGANIZATION	EDUCATIONAL TV/RADIO ADVISORY ORGANIZATION	TELECOMMUNICATIONS OPERATIONAL UNIT	CIVIL DEFENSE	FUNDING
IOWA (Enacted 1967)	STATE COMMUNICATIONS ADVISORY COUNCIL, 7 MEMBERS DESIGNATED BY STATUTE.	STATE EDUCATIONAL RADIO AND TELEVISION FACILITY BOARD; 9 MEMBERS DESIGNATED BY STATUTE; POWER TO ACQUIRE PROPERTY AND FACILITIES AND APPLY FOR BROADCASTING LICENSES.	COMMUNICATIONS DIVISION ESTABLISHED IN COMPTROLLER'S OFFICE; STANDARDIZE COMMUNICATIONS PROCEDURES AND POLICIES TO STATE GOVERNMENT; PROMULGATE RULES AND REGULATIONS.	CIVIL DEFENSE RETAINS FULL RESPONSIBILITY FOR EMERGENCY TELECOMMUNICATIONS DURING TIME OF DISASTER OR CIVIL EMERGENCY.	$500,000 FROM THE GENERAL FUND TO IMPLEMENT AN ETV SYSTEM.
MASSACHUSETTS (Proposed 1968)	STATE TELECOMMUNICATIONS ADVISORY COUNCIL, 12 MEMBERS, DESIGNATED BY STATUTE; POLICY AND PROCEDURES RECOMMENDATIONS	EDUCATIONAL COMMUNITY HAS REPRESENTATION ON ADVISORY COUNCIL AND FORMAL MECHANISMS FOR COORDINATION WITH THE TELECOMMUNICATIONS BUREAU	TELECOMMUNICATIONS BUREAU, EXECUTIVE OFFICE FOR ADMINISTRATION AND FINANCE, CENTRAL SERVICES DIVISION; TO CONSOLIDATE AND ADMINISTER ALL FACILITIES, EQUIPMENT, AND PURCHASES.	EMERGENCY COMMUNICATIONS COMMISSION IN CIVIL DEFENSE AGENCY, APPOINTED BY GOVERNOR; COORDINATES WITH OTHER STATE AGENCIES.	TELECOMMUNICATIONS REVOLVING FUND TO BE ESTABLISHED.
NEBRASKA (Enacted 1967)	STATE TELECOMMUNICATIONS BOARD, 7 MEMBERS, DESIGNATED BY STATUTE; ADVICE IN PLANNING MANAGEMENT, AND ADMINISTRATION OF STATE TELECOMMUNICATIONS SYSTEM.	INDEPENDENT EDUCATIONAL TV COMMISSION; EXCLUDED FROM TERMS OF TELECOMMUNICATIONS ACT EXCEPT FOR MUTUALLY AGREED UPON COOPERATION FOR SERVICES, ASSISTANCE, AND EMERGENCY USE OF THE ETV NETWORK.	TELECOMMUNICATIONS DIVISION, DEPARTMENT OF ADMINISTRATIVE SERVICES; CONSOLIDATE, ADMINISTER, MANAGE PURCHASES FOR ALL TELECOMMUNICATIONS SERVICES; COORDINATE WITH OTHER AGENCIES, ESPECIALLY CIVIL DEFENSE.	LEGISLATIVE REQUIREMENT FOR CLOSE COORDINATION BETWEEN TELECOMMUNICATIONS DIVISION AND CIVIL DEFENSE AGENCY.	TELECOMMUNICATIONS REVOLVING FUND ESTABLISHED IN GENERAL SERVICES.
NORTH CAROLINA (Enacted 1967)	ETV ONLY, SEE COLUMN 2.	INSTRUCTIONAL TV PROGRAMMING AND DISTRIBUTION ASSIGNED TO STATE DEPARTMENT OF PUBLIC INSTRUCTION.			FINANCED THROUGH REVENUE FOR PUBLIC SCHOOLS.
PENNSYLVANIA (Enacted 1968)	PUBLIC TV NETWORK COMMISSION ONLY, SEE COLUMN 2.	PENNSYLVANIA PUBLIC TV NETWORK COMMISSION, 11 MEMBERS DESIGNATED BY STATUTE; TO ESTABLISH AND FUND A STATEWIDE PUBLIC TV NETWORK			$1.3 MILLION TO ASSIST PUBLIC TV STATIONS.
SOUTH CAROLINA (Enacted 1960)	ETV ONLY, SEE COLUMN 2.	ETV COMMISSION, 11 MEMBERS, DESIGNATED BY STATUTE; OVERSEES OPERATION OF STATEWIDE ETV NETWORK.			

local agencies such rules, regulations, procedures, and methods of operation as it deems necessary to effectuate the most economical and efficient use of publicly owned and operated communications facilities within this state." [7] An enabling act relating to the Board, and relevant sections of the State Administrative Manual setting forth the responsibilities of the Communications Division are included as exhibits in Appendix A.

South Carolina presents a case in which there is strong central administrative authority for educational TV, but no similar organization to manage the telecommunications affairs of the noneducational State agencies. The South Carolina ETV network, with 800 channel miles of microwave and 1,500 channel miles of cable, is oriented toward the secondary schools and is one of the nation's most advanced common carrier networks. The State has created a 12-member Educational Television Commission that includes six public members and is supported by advisory committees of educators and technical experts.

The State of Nebraska, which has a State-owned microwave network under construction, has perhaps the most comprehensive telecommunications management structure of the states surveyed. There is statutory provision for a Telecommunications Division, a State Telecommunications Board, and an independent Educational Television Commission. The Division, a unit of the Department of Administrative Services, has statutory authority to consolidate and administer telecommunications activities and to manage purchases for telecommunications services and facilities. The law spells out that the Division will maintain close liaison with the State Civil Defense Agency. The Nebraska Legislature specifically excluded ETV from the act except for mutually agreed upon cooperation with the Telecommunications Division. In Nebraska, provision has been made for policy guidance, operational management, education, and civil defense.

Iowa and Massachusetts, like California and Nebraska, emphasize both an advisory board and a day-to-day telecommunications management department. Similarly, all four states have created machinery that gives substantial autonomy to ETV functions. Colorado, South Carolina, Pennsylvania, and North Carolina, however, have thus far concentrated most of their efforts on ETV and show no systematic planning for other telecommunications operations. Idaho has established a Division of Communications within its Department of Administrative Services to carry out much the same functions as operational divisions discussed earlier.

A study of relevant legislation reveals that those states with comprehensive telecommunications plans have chosen an organizational structure comprising both an advisory board or commission and an operational unit to exercise administrative control over telecommunications services, facilities, and equipment acquisition. Those experienced in public administration will be quick to see the wisdom of this approach. An advisory commission, created by statute and clothed with executive-level authority, can more easily maintain the professional distance so desirable in setting policy and adjudicating differences among competing needs of the respective state agencies. Moreover, such a commission carries sufficient force to make its decision stick. Finally, it can be so constituted that vital points of view and necessary expertise are adequately represented.

The State will probably want to give serious thought to the role of education in any future State telecommunications management program. This is especially relevant as ETV and computer-aided instruction appear to be gaining stature and acceptance as instructional tools and in bringing vast new potential to public instruction. ETV will have even greater complexity and geographical scope in Illinois and will call for increasing interface between State government, local school districts, higher education, and public TV licensees. This interface, moreover, must not fail to take into account the wide range of differences posed by the State's diversity. Rural educators will not always be attuned to the needs of urban districts, nor will local educators always share the goals of course designers in the Office of the Superintendent of Public Instruction.

Resolving these differences is often a matter of no small political delicacy, and may be achieved more successfully by legislative creation of an independent educational TV commission that mirrors conflicting points of view, embodies specialized educational expertise, and is empowered to establish overall policy guidance. Administration of educational TV networks, owing to the individuality of course content, might well remain the prerogative of individual licensees.

THE CRUCIAL ROLE OF THE OPERATING DIVISION

Without underestimating the importance of a competent and interested advisory board and a technically well-designed telecommunications system, it is still accurate to say that a conscientious, adequately staffed, well funded operating division is the single most necessary ingredient in the establishment of a telecommunications management system. Such an operating division has the responsibility for conducting the day-to-day and long-term activities of planning, direction, and control necessary to assure adequate communication services and capacity for each using agency. The basic responsibilities of the division can be summarized as follows:

- Provide access for each using agency to a reliable and economical system capable of providing the type, volume, and speed of communications required to conduct the agency's business.

- Plan for future needs by anticipating growth and maintaining a communications system capable of assimilating new equipment and services.

- Provide protection of the communications system from natural and man-made disasters by providing as many alternative routes as economically and technically feasible.

Organization of the Division

To meet its basic responsibilities, the division must be structured on a functional basis. Figure 3-1 depicts a typical division organized to carry out specific functional activities. The basic organization and the functional responsibilities identified are based on interviews and discussion with representatives of various State agencies. The organization has four operating units that report to the Director. The four units are Engineering and Systems, Operational Facilities, Administrative Services, and Budget and Purchasing. The specific titles and number of units may differ from those in Figure 3-1. since both will be somewhat arbitrary in the beginning and will evolve as the division's role becomes firmly established. The functions identified for each unit are considered a minimum necessity to accomplish the division's initial objectives. Figure 3-1 has general applicability to telecommunications activities in many states.

Engineering and Systems Unit

The Engineering and Systems Unit is responsible for providing complete engineering services and systems management for all agencies in all matters of telecommunications. Specialization within the unit will be required to provide teams with competence for professional engineering tasks.

Engineering Services will perform system design, the development of equipment specifications, modification of equipment as required, liaison on equipment questions with common carriers, equipment installation and maintenance, equipment control and inventory, and engineering consultation for any agency requiring such service.

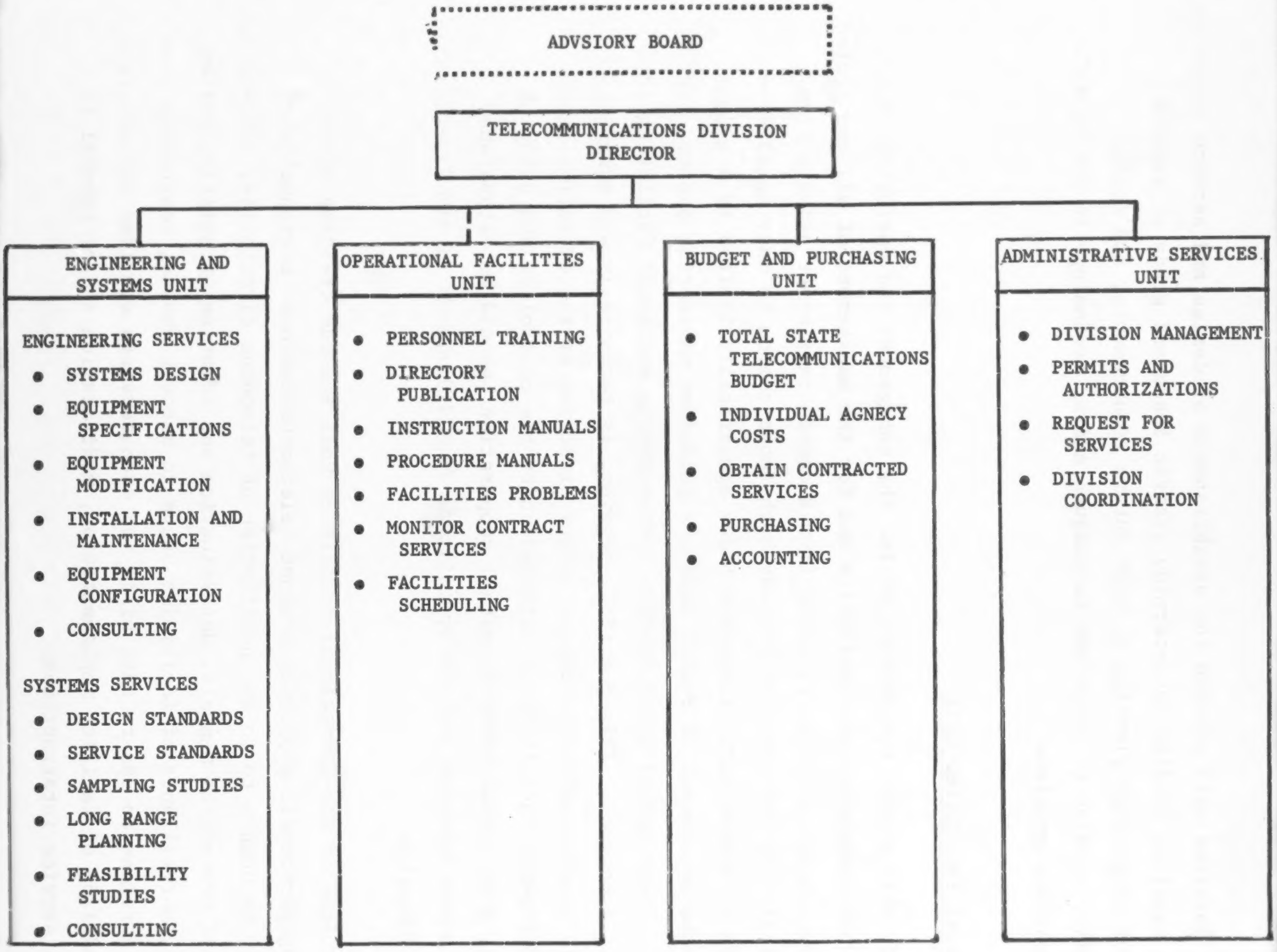
ADVSIORY BOARD
TELECOMMUNICATIONS DIVISION DIRECTOR
ENGINEERING AND SYSTEMS UNIT
ENGINEERING SERVICES
• SYSTEMS DESIGN
• EQUIPMENT SPECIFICATIONS
• EQUIPMENT MODIFICATION
• INSTALLATION AND MAINTENANCE
• EQUIPMENT CONFIGURATION
• CONSULTING
SYSTEMS SERVICES
• DESIGN STANDARDS
• SERVICE STANDARDS
• SAMPLING STUDIES
• LONG RANGE PLANNING
• FEASIBILITY STUDIES
• CONSULTING
OPERATIONAL FACILITIES UNIT
• PERSONNEL TRAINING
• DIRECTORY PUBLICATION
• INSTRUCTION MANUALS
• PROCEDURE MANUALS
• FACILITIES PROBLEMS
• MONITOR CONTRACT SERVICES
• FACILITIES SCHEDULING
BUDGET AND PURCHASING UNIT
• TOTAL STATE TELECOMMUNICATIONS BUDGET
• INDIVIDUAL AGNECY COSTS
• OBTAIN CONTRACTED SERVICES
• PURCHASING
• ACCOUNTING
ADMINISTRATIVE SERVICES UNIT
• DIVISION MANAGEMENT
• PERMITS AND AUTHORIZATIONS
• REQUEST FOR SERVICES
• DIVISION COORDINATION

Figure 3-1

Typical Telecommunication Management Organization with Unit Functions

Systems Services will provide the establishment of design and service standards, perform sampling studies to determine traffic loads and grade of service, carry out long-range planning to meet future requirements, and conduct feasibility studies to adapt new techniques and/or technology to the State's communications problems.

Operational Facilities Unit

This unit will accept responsibility for the management and operation of all State-owned communications facilities and for the management of all contracted telecommunication services procured from a common carrier or private firm. These facilities and services include both those common to many agencies--intercity telephone facilities--and those specifically limited to a single agency--the Department of Public Health's pollution monitoring system, for example. There may be valid reasons for excluding emergency facilities from this unit's control. This question, however, is technically and administratively complex and will require policy direction at the executive level. Should emergency facilities be retained under the control of the using agencies, some formal means of mutual cooperation should be established between these agencies and the Operational Facilities Unit of the Telecommunications Division.

The functions of the Operational Facilities Unit include training agency operating personnel, supplying trained telecommunications personnel when an agency is unable to do so, publication of telephone directories, instruction books, and procedures manuals, determination and solution of existing system problems, surveillance of facilities usage to uncover abuses, monitoring contracted services to assure that bills for such services are true and accurate, and scheduling of facility implementation, modification and/or removal to minimize service interruptions.

This unit would be structured to include several subordinate units based on these considerations: (1) the type of telecommunication service provided, e.g., radio, telephone, teletype; (2) the type of traffic handled, e.g., administrative, emergency, educational, data; or (3) common agency requirements, e.g., multi-agency statewide law enforcement network, a State-owned administrative voice network.

The Operational Facilities Unit would be the key element in any State program to implement the cost reduction recommendations presented in the preceding chapter of this report. Additionally, this unit would be expected to continually evaluate the procedures for maintaining and improving cost control. Some of these procedures are discussed below.

Budget and Purchasing Unit

This unit will be responsible for establishing the budgeting requirements for telecommunication facilities and services for the entire State, for negotiating and securing all contractual services, for purchasing all components and equipment, and for maintaining the accounting required. A major task for the unit will be to establish and administer a system for prorating telecommunications charges to each individual agency based on the amount of usage by that agency. The unit will maintain and disseminate accurate accounting of agency telecommunications costs so that they can intelligently plan their individual budget requests.

Administrative Services Unit

This unit will perform all internal administrative functions required to operate the Telecommunications Division. These include establishment of the division budget and the planning, directing, and controlling of the division's resources. The unit will also function as the focal point for obtaining all permits and authorizations required for telecommunications and for the processing of individual agency requests for services.

Division Coordination

To function smoothly, the division will require the establishment of policies and procedures for internal coordination. The organization should be structured on the basis that there must be considerable interfacing between the various units. While the actual responsibility for the control of specific costs and/or the determination of a specific systems performance level may be the function of a particular organizational unit, the information needed to perform this function will come from one or more other organizational units. For example, while the Engineering and Systems Unit may be responsible for conducting all traffic loading and utilization studies, plus the inventory of actual installations, this information is required by the Operations Facility Unit to control both local and intercity telephone costs. Such cost control is exercised by coordinating traffic and usage data with (1) tariff applications, (2) billing reconciliation, (3) established statewide standards of equipment needs, (4) network access policies, (5) overflow toll policies, (6) credit card and collect call policies, and (7) other policies on system abuse and misuse.

In addition, interaction between organizational units on a consultation and advisory basis is also required in order to understand the various factors of any particular system that affect its costs and performance. For example: What mechanical devices can be procured or what manual checkout procedures can be used to indicate failure of one or more of a group of dedicated lines carrying heavy traffic loads? This is of particular importance where route advance circuitry is used to switch outgoing calls to toll trunks when all the dedicated lines are busy. Inability to detect failure of one or more of these lines can generate many extra high cost toll calls while at the same time the State is paying for a service that has partially failed. Another example: If employees are to be permitted dial access to dedicated lines being used as long distance trunks, what type of manual supervision or hardware (such as automatic billing equipment) should be used to assure that these lines are used only for government business and not for personal calls? Free, undetected, personal long-distance calls by State employees can seriously overload State telecommunications facilities and add greatly to both the obvious and hidden telecommunications costs.

The above examples serve to illustrate the extent and nature of the inter-unit coordination that must exist for the Telecommunications Division to function properly. A major job in the establishment of any telecommunications management organization will be that of defining both explicit areas of responsibility and the interface responsibilities within the organization.

Implementation

Implementation by Illinois of a telecommunications management structure will require the enactment of legislation by the General Assembly and perhaps an Executive Order by the Governor. The precise structure of both an Advisory Board and a Telecommunications Division can best be defined for the ITC by those having knowledge of the governmental structure and legislative requirements of the State of Illinois. As shown in Table 3-1 there is sufficient variety in the legislation of other states to suggest a number of legislative alternatives which Illinois may adapt to its specific needs.

Assuming that such legislation will be enacted and a telecommunications division will be established, a minimum of 18 months will probably be required to build the full complement of personnel and to achieve full operational efficiency.

The exact number and types of division personnel will depend on the charter of responsibility given to the division. If the division is to be responsible for all State telecommunications, including those of higher education, it will be of substantial size. Discussions with state personnel on the size of a telecommunications division capable of assuming the responsibilities outlined, indicated that the division would require a staff of approximately 80. This staff would consist of about one-third professional people, such as the engineering, supervisory and executive categories and two-thirds nonprofessionals, such as clerks, secretaries, technicians, etc. The staff of 80 does not include higher educational institutional employees or switchboard operators.

Whatever the ultimate size of the division, its establishment should take place in a progression of steps to allow for an orderly transition of responsibilities from the various agencies to the division, and for the establishment of the new activities engendered by the integration of State facilities.

The proposed telecommunications division is costed on the basis of an 18-month implementation plan with the following assumptions:

- An average professional salary of $12,000 per year and a nonprofessional salary of $6,500 per year. These figures were obtained as averages from the various position titles and their salary ranges as specified in the 75th Biennium Personnel Detail of the State of Illinois
- Operating costs as a percentage of labor cost for:

Contractual Services	16.5%
Travel	2.8%
Commodities	4.3%
Printing	2.5%
Equipment	4.3%

These figures were obtained as averages from existing State organizations considered to be representative in an operational framework to the proposed organization. Based upon these assumptions, the estimated costs of establishing a telecommunications division are:

- First Six-Month Period

10 Professionals	@ $12,000/yr	$ 60,000
15 Nonprofessionals	@ 6,500/yr	48,750
Direct Salaries		$108,750
Contractual Services		$ 17,944
Travel		3,045
Commodities		4,676
Printing		2,719
Equipment		4,676
Total		$141,810

- Second Six-Month Period

20 Professionals	@ $12,000/yr	$120,000
35 Nonprofessionals	@ 6,500/yr	113,750
Direct Salaries		$233,750
Contractual Services		$ 38,569
Travel		6,545
Commodities		10,051
Printing		5,844
Equipment		10,051
Total		$304,810

- Final Six-Month Period

25 Professionals	@ $ 12,000/yr	$150,000
55 Nonprofessionals	@ 6,500/yr	178,750
Direct Salaries		$328,750
Contractual Services		54,244
Travel		9,205
Commodities		14,136
Printing		8,219
Equipment		14,136
Total		$428,690

The yearly cost of the fully staffed Telecommunications Division is estimated to be:	$857,380

COMPUTERIZATION OF TELECOMMUNICATIONS MANAGEMENT METHODS

Regardless of the structure adopted for the telecommunications management system, there appear to be specific areas where the application of new techniques would aid substantially in the management of telecommunications activities. One promising area is that of tariffs and their application. Adequate knowledge of telephone tariffs is required to: (1) determine correct charges for services received, (2) estimate the costs of planned facilities and services, (3) economically request and make changes to existing facilities, and (4) know what information the common carrier is required to provide if requested. Excess costs may result from uncertain knowledge of applicable tariffs. For example, a large number of tariffs are involved in a request to move and change a telephone system consisting of a substantial number of pushbutton phones. These include tariffs for each feature of the pushbutton phone such as the numbers of pushbuttons, wink lights, hold features, and alternative answering features; the types of connecting lines and instruments; and whether the installation was made at the time of removal of other equipment or required a special service call. Lack of understanding of the tariff subtleties involved in ordering these changes could result in greatly increased cost at no corresponding increase in service.

The State could acquire adequate tariff knowledge by obtaining the services of a consultant specializing in the interpretation of tariffs, or by establishing a computerized library of tariffs for checking each new application for service to determine the minimum cost of implementation. Such a data base would require substantial initial effort and subsequent updating, but once defined and maintained would be a major tool for all elements of a telecommunications management organization.

Similar automated data bases could also be established for: (1) evaluating comparative costs of standard supplemental equipment offered by common carriers and other suppliers, (2) maintaining an inventory of all telecommunication facilities and services owned by the State, furnished by a common carrier, or leased from a private organization, and (3) scheduling preventive maintenance and recording the maintenance history of existing facilities. The possibilities for the use of automated computerized data bases appear to be well suited to many of the functions that will be performed in the management of telecommunications.

With the substantial investment of the State of Illinois in digital computer installations, it appears feasible to make maximum use of such facilities in the performance of the activities of telecommunications management.

PART FOUR: 1975 NETWORK REQUIREMENTS AND POSSIBLE APPROACHES

This part of the report presents telecommunications requirements for Illinois through 1975, and discusses a number of approaches for meeting them.

The requirements are based on a recapitulation of data presented in Report B, but are updated to make allowance for information collected since publication of that document. Wherever data reformatting has been necessary, the reader is furnished both a justification for the change and a reference to the affected sections of Report B.

Ten network arrangements are described and evaluated in terms of their capabilities for meeting the State's telecommunications requirements over the seven-year projection period. The network alternatives that meet the minimum requirements and appear to be competitive in price are costed. Alternatives that are obviously incapable of meeting the minimum requirements, or though meeting the requirements are clearly not competitive in price, are dropped from further consideration.

REQUIREMENTS

This section follows the format of Report B, in that requirements are divided into four broad facility areas: intercity telephone, land mobile radio, ETV, and Civil Defense.

Intercity telephone requirements include provisions for data as well as voice. Both normal and priority traffic have been considered as part of the voice and data traffic volume. The former, being relatively routine, can utilize general-use facilities shared by all agencies, while the latter consists of urgent messages requiring private dedicated lines. The four agencies with priority requirements are the State Police, the Division of Highways, the Department of Mental Health, and the Civil Defense Agency.

Land mobile radio requirements are presented for the State Police, Highways, Mental Health, Conservation, Secretary of State, and Higher Education. Higher education requirements cover the six State universities as they use radio for campus security, fire protection, plant maintenance, and related activities.

ETV requirements are taken to be those specified in the 1964 Jansky and Bailey report.[6] That report calls for a microwave network that achieves state-wide coverage by interconnecting 16 VHF and UHF TV broadcast transmitters and the state's six major university campuses. The requirement for this functional capability is treated as basic in the present report, whether the system is common carrier or state-owned/leased, and whether it stands alone or is considered in combination with an administrative network.

Civil Defense requirements are a special case, owing to the unique needs of the State Civil Defense Agency. There is a requirement not only for a highly reliable primary communications system between the Emergency Operations Center at Springfield and the nine Mutual Aid Areas in the State, but also for dependable back-up facilities. Because of its responsibilities in the national civil defense system, the State Civil Defense Agency also presents an additional requirement for communications with surrounding states in Civil Defense Region Four and to Region Four headquarters in Battle Creek, Michigan.

Growth Projections: A Recapitulation

Before getting into the detailed discussions of projected State telecommunications requirements, it may be useful to recapitulate projections made in Report B for the major State agencies.

Report B projected 1975 telecommunications requirements and costs for 22 major State organizations, including institutions of higher learning. Together, the 22 organizations represented nearly 95 percent of future telephone requirements and more than 98 percent of projected radio traffic. The analysis was presented on an agency-by-agency basis. Anticipated trends in employment, budget growth, and telecommunications requirements were used to extrapolate future telecommunications costs through 1975.

Table 4-1 pulls together the separate agency analyses to provide a comprehensive summary of projected agency employment, budget, and telecommunications growth. In the table, data for the separate institutions of higher learning are combined under the heading Higher Education. Student enrollment projections, based on the Illinois Board of Higher Education Master Plan - Phase II, are substituted for employment growth to provide a more meaningful indication of the sharp demands faced by the State's junior and senior colleges. Table 4-1 also incorporates minor revisions in the material presented in Report B, and replaces Table 3 of that document. The projected 1975 costs shown in the Table are just convenient indices for projecting the State's growth patterns and are not related to the costs developed later in this document on the comparative alternative implementation plans which may turn out to be higher or lower than the projections.

Intercity Network Requirements: Telephone

Intercity telephone requirements will increase sharply in Illinois over the next seven years. Report B furnished projections of future telephone message volume requirements for the State's 23 most heavily used intercity telephone corridors. This section supplements those requirements by adding message volumes for 47 additional corridors that define the principal operational channels in use by the State Police, the Division of Highways, and the Department of Mental Health. The total of 70 corridors analyzed in this section hub on Springfield (44), Chicago (19), Champaign (4), and Edwardsville (3).

The augmented intercity telephone requirements for 1975 are presented in Table 4-2. Requirements are stated in total city-to-city calls per month and are

Table 4-1

Projected Employee, Budget and Telecommunications Growth for Major Users

NAME OF AGENCY	EMPLOYMENT			BIENNIUM TOTAL BUDGET			TELECOMMUNICATIONS COSTS PER YEAR		
	1	2	3	4	5	6	7	8	9
	CURRENT (1968)	% CHANGE BY 1975	1975 PROJECTED	EXPENDITURE 73rd	APPROPRIATED 74th	RECOMMENDED 75TH	CURRENT	% CHANGE BY 1975	1975 PROJECTED
SECRETARY OF STATE	3,400	20	4,080	$ 40,449,336	$ 56,711,506	$ 67,375,561	$ 206,722	70	$ 351,427
MILITARY AND NAVAL	380	10	418	5,548,348	6,214,238	6,678,254	89,042	80	160,276
SUPT. OF PUBLIC INSTRUCTION	1,000	90	1,900	463,656,637	712,401,706	975,964,273	204,741	90	389,008
CHILD & FAMILY SERVICES	2,375	25	2,969	44,172,839	51,861,743	65,459,537	148,321	60	237,314
CONSERVATION	700	15	805	18,270,758	30,006,120	58,202,268	73,249	65	120,861
GENERAL SERVICES	700	180	1,960	---	---	---	27,423	50	41.135
LABOR	3,200	90	6,080	43,258,659	49,980,699	56,108,864	335,296	30	435.885
MENTAL HEALTH	22,500	40	31,500	295,430,851	407,476,119	536,780,708	1,148,445	50	1,722,668
PERSONNEL	160	20	192	1,615,200	2,261,900	2,896,613	15,955	160	41.483
PUBLIC AID	5,600	20	6,720	604,556,192	658,220,829	862,923,417	200,886	40	281,240
PUBLIC HEALTH	1,310	22	1,598	41,105,948	59,483,915	80,526,412	81,856	80	147,341
PUBLIC SAFETY	4,000	22	4,880	71,599,039	87,258,051	106,830,288	380,010	70	646,017
PUBLIC WORKS & BUILDING	7,150	23	8,795	743,913,590	1,081,867,133	1,139,880,348	553,225	50	829,838
REVENUE	930	3	958	46,313,268	66,060,534	51,820,233	92,832	35	125,323
YOUTH COMMISSION	1,900	35	2,565	20,834,668	29,249,083	40,547,197	100,881	119	220,929
HIGHER EDUCATION**	175,000*	---	397,000*	410,998,174	482,709,096	637,816,741	4,785,981	---	11,964,953
TOTALS	55,305	---	130,725	$2,851,723,507	$3,781,762,672	$4,689,810,714	$8,444,865	---	$17,715,698
OVERALL % OF GROWTH		136						110	

*Revised to include data received after publication of Report B, September 30, 1968.

**For Higher Education, student enrollments are used instead of employment, and totals under Columns 1 and 3 include only noneducational State employment. Enrollments, calculated for both junior and senior educational institutions, are felt to be the most meaningful indicators of change in the educational sector. In Columns 4, 5, and 6, budget totals for Higher Education include State grants-in-aid to the junior colleges.

Table 4-2

Projected Monthly Call Volumes to 1975--Normal and Priority Traffic

				PRIORITY											
	NORMAL			POLICE			HIGHWAYS			MENTAL HEALTH			TOTAL		
SPRINGFIELD TO:	1968	GROWTH FACTOR (%)	1975	1968	GROWTH FACTOR (%)	1975	1968	GROWTH FACTOR (%)	1975	1968	GROWTH FACTOR (%)	1975	1968	GROWTH FACTOR (%)	1975
Albion	--	--	--	107	40	150	--	--	--	--	--	--	107	40	150
Alton	2,244	60	3,590	--	--	--	--	--	--	276	60	442	2,520	60	4,032
Anna	288	50	432	--	--	--	--	--	--	600	50	900	888	50	1,332
Aurora	406	50	609	--	--	--	--	--	--	--	--	--	406	50	609
Bloomington	2,597	80	4,675	--	--	--	--	--	--	--	--	--	2,597	80	4,675
Blue Island	--	--	--	494	40	692	--	--	--	--	--	--	494	40	692
Cairo	--	--	--	118	40	165	--	--	--	--	--	--	118	40	165
Carbondale	4,451	55	6,903	--	--	--	1,136	30	1,477	--	--	--	5,587	50	8,380
Centralia	--	--	--	--	--	--	--	--	--	327	60	523	327	60	523
Champaign	7,931	65	13,047	--	--	--	--	--	--	600	100	1,200	8,531	67	14,247
Chicago	44,683	125	100,437				2,500	30	3,250	3,300	200	9,900	50,483	125	113,587
Collinsville	3,511	61	5,618	622	40	871	--	--	--	--	--	--	4,133	57	6,489
Decatur	2,932	67	4,909	--	--	--	--	--	--	604	100	1,208	3,536	73	6,117
Des Plaines	197	40	275	349	40	489	--	--	--	--	--	--	546	40	764
Dixon	290	30	377	--	--	--	884	30	1,149	--	--	--	1,174	30	1,526
Du Quoin	126	40	176	357	40	500	--	--	--	--	--	--	483	40	676
East St. Louis	252	20	302	--	--	--	1,824	20	2,189	--	--	--	2,076	20	2,491
Edwardsville	907	30	1,179	--	--	--	--	--	--	--	--	--	907	30	1,179
Effingham	248	30	322	--	--	--	752	30	978	--	--	--	1,000	30	1,300
Elgin	2,628	60	4,195	512	40	717	1,468	30	1,908	--	--	--	4,608	48	6,820
Galesburg	108	53	165	--	--	--	--	--	--	350	10	385	458	20	550
Germantown	--	--	--	370	40	518	--	--	--	--	--	--	370	40	518
Harrisburg	--	--	--	--	--	--	--	--	--	394	60	630	394	60	630
Hinsdale	912	52	1,386	189	40	265	--	--	--	--	--	--	1,101	50	1,651
Jacksonville	1,609	46	2,357	--	--	--	--	--	--	1,052	20	1,262	2,661	36	3,619
Joliet	2,127	60	3,402	521	40	729	--	--	--	--	--	--	2,648	56	4,131
Kankakee	730	40	1,022	108	40	151	--	--	--	--	--	--	838	40	1,173
Lincoln	1,164	62	1,891	--	--	--	--	--	--	688	150	1,720	1,852	95	3,611
Litchfield	396	23	489	252	40	353	--	--	--	--	--	--	648	30	842
Macomb	539	72	931	349	40	489	--	--	--	--	--	--	888	60	1,420
Menard	--	--	--	--	--	--	--	--	--	290	20	348	290	20	348
Ottawa	1,249	32	1,652	--	--	--	1,568	30	2,038	--	--	--	2,817	31	3,690
Paris	--	--	--	--	--	--	1,659	13	1,875	--	--	--	1,659	13	1,875
Pecatonica	--	--	--	109	40	153	--	--	--	--	--	--	109	40	153
Peoria	5,846	81	10,582	--	--	--	920	30	1,196	428	140	1,027	7,194	78	12,805
Peru	--	--	--	187	40	262	--	--	--	--	--	--	187	40	262
Pestum	--	--	--	643	40	900	--	--	--	--	--	--	643	40	900
Pittsfield	--	--	--	198	40	277	--	--	--	--	--	--	198	40	277
Pontiac	272	10	298	563	40	788	--	--	--	--	--	--	835	30	1,086
Quincy	992	50	1,488	--	--	--	--	--	--	--	--	--	992	50	1,488
Rock Island	2,078	52	3,167	491	40	687	--	--	--	--	--	--	2,569	50	3,854
Rockford	1,619	60	2,590	--	--	--	--	--	--	--	--	--	1,619	60	2,590
Sterling	219	11	243	412	40	577	--	--	--	--	--	--	631	30	820
Watson	--	--	--	302	40	423	--	--	--	--	--	--	302	40	423
TOTAL	93,551	+ 91%	178,709	7,253	+ 40%	10,156	12,711	+ 27%	16,060	8,909	+119%	19,545	122,424	+ 83%	224,470

Table 4-2

(Continued)

	NORMAL			PRIORITY									TOTAL		
				POLICE*			HIGHWAYS*			MENTAL HEALTH					
CHICAGO TO:	1968	GROWTH FACTOR (%)	1975	1968	GROWTH FACTOR (%)	1975	1968	GROWTH FACTOR (%)	1975	1968	GROWTH FACTOR (%)	1975	1968	GROWTH FACTOR (%)	1975
Aurora	698	50	1,047							—	—	—	698	50	1,047
Bloomington	327	80	589							—	—	—	327	80	589
Carbondale	354	50	531							—	—	—	354	50	531
Champaign	16,862	100	33,724							—	—	—	16,862	100	33,724
Decatur	225	50	338							—	—	—	225	50	338
De Kalb	2,312	100	4,624							—	—	—	2,312	100	4,624
Dixon	330	5	345							420	50	630	750	30	975
Dwight	—	—	—							166	70	282	166	70	282
East Moline	—	—	—							221	50	332	221	50	332
East St. Louis	153	50	230							—	—	—	153	50	230
Edwardsville	176	50	264							—	—	—	176	50	264
Elgin	2,358	73	4,086							928	90	1,763	3,286	78	5,849
Joliet	1,094	60	1,750							—	—	—	1,094	60	1,750
Kankakee	236	150	590							388	150	970	624	150	1,560
Macomb	149	50	224							—	—	—	149	50	224
Manteno	161	30	210							1,332	30	1,731	1,493	30	1,941
Peoria	465	60	744							—	—	—	465	60	744
Rockford	418	50	627							436	50	654	854	50	1,281
Tinley Park	—	—	—							361	50	542	361	50	542
TOTAL	26,318	+ 90%	49,923	—	—	—	—	—	—	4,252	+ 62%	6,904	30,570	+ 86%	56,827
CHAMPAIGN TO:															
Bloomington	856	60	1,370							—	—	—	856	60	1,370
Carbondale	380	60	608							—	—	—	380	60	608
Danville	1,176	50	1,764							—	—	—	1,176	50	1,764
Decatur	1,378	50	2,067							—	—	—	1,378	50	2,067
TOTAL	3,790	+ 53%	5,809	—	—	—	—	—	—	—	—	—	3,790	+ 53%	5,809
EDWARDSVILLE TO:															
Alton	4,896	100	9,792							—	—	—	4,896	100	9,792
Carbondale	6,523	100	13,046							—	—	—	6,523	100	13,046
East St. Louis	13,369	100	26,738							—	—	—	13,369	100	26,738
TOTAL	24,788	+100%	49,576	—	—	—	—	—	—	—	—	—	24,788	+100%	49,576
GRAND TOTALS	148,447	+ 91%	284,017	7,253	+ 40%	10,156	12,711	+ 27%	16,060	13,161	+101%	26,449	181,572	+ 85%	336,682

*State Police and Highways systems are connected to Springfield.

projected to increase from about 181,600 in 1968 to nearly 336,700 in 1975. This represents an overall growth rate of 85 percent. Table 4-2 also lists the individual growth rates for each of the 70 corridors. Expressed in terms of calls to and from hub cities, these increases are: Springfield, 83 percent; Chicago, 86 percent; Champaign, 53 percent; and Edwardsville, 100 percent. By 1975, intercity calls in the Springfield corridors will account for about two-thirds of all intercity traffic shown in Table 4-2. The Table does not contain any entries for the Civil Defense Agency since that agency does not yet have a network in operation. (This replaces Table 4, page 95, Report B.)

Table 4-2 is arranged to distinguish between normal and priority traffic within individual corridors. Normal traffic is characterized by its nonurgent nature, by absence of emergency requirements, and by its ability to be routed over shared facilities, thus allowing maximum efficiency in the use of such facilities. Priority traffic, transmitted by the State Police, the Division of Highways, the Department of Mental Health, and the Civil Defense Agency, is dedicated to urgent business and emergency use and requires exclusive facilities to ensure high reliability. Telephone lines in these priority subsystems must be available at all times, whether or not they are heavily used. Figure 4-1 illustrates the difference between normal and priority traffic.

All three independent subsystems, in use several years by the respective agencies, are characterized by special switching that allows any point in the system to access any other point directly. From this standpoint, and since the subsystems are for the sole use of the respective agencies, the priority subsystems are analogous to private networks. Table 4-2 includes some cities that are not now in the operational networks. It is postulated in these cases that future growth will require voice linkage to these locations.

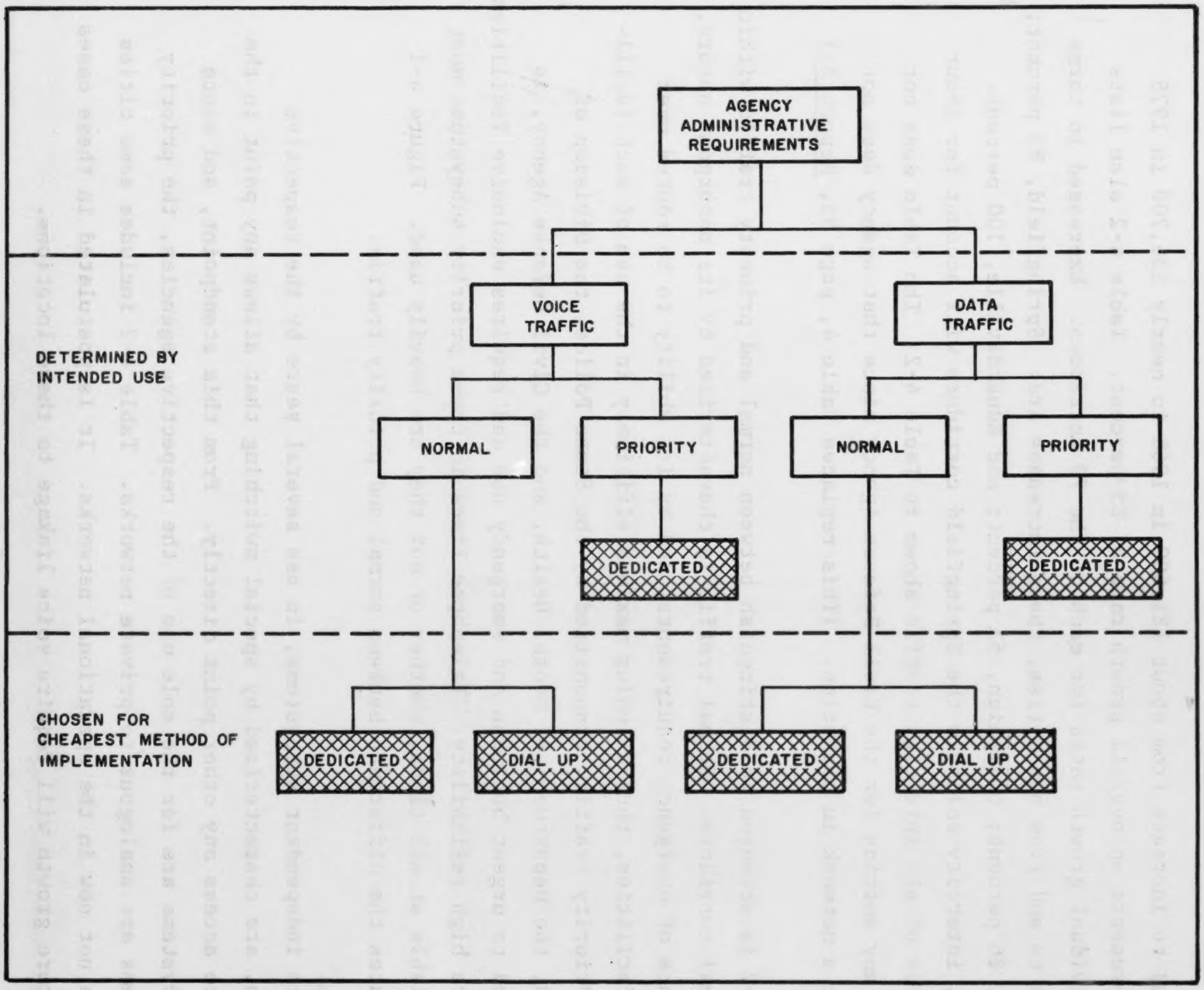
AGENCY ADMINISTRATIVE REQUIREMENTS
VOICE TRAFFIC
DATA TRAFFIC
DETERMINED BY INTENDED USE
NORMAL
PRIORITY
NORMAL
PRIORITY
DEDICATED
DEDICATED
CHOSEN FOR CHEAPEST METHOD OF IMPLEMENTATION
DEDICATED
DIAL UP
DEDICATED
DIAL UP

Figure 4-1
Agency Administrative Requirements

Line Requirements

To determine the number of lines needed, requirements from Table 4-2 were converted to dedicated, dial access, voice grade lines and projected for both P-1 and P-10 grades of service.[*] The present grade of service, calculated in Report A to range from P-17 to P-97, is considered generally inadequate; P-10 is regarded by SDC as a reasonable cost/service compromise.

Table 4-3 shows line requirements for the intercity augmentation plan. The organization of Table 4-3 is similar to that followed earlier for Table 4-2 and indicates that the augmented network is intended to handle both normal and priority traffic. Just over 800 lines are required to achieve P-1 service, while 625 are needed for P-10. In both cases, the Springfield circuits account for more than 65 percent of the estimated lines.

Intercity Network Requirements: Data Lines

Data systems, ten of which are now in the developmental stage, are being planned as single-purpose networks to meet the data needs of specific state agencies. Table 4-4, based on information obtained from the agencies since publication of Report B, presents data system requirements as they are now conceived for the respective systems. It will be seen that only two agencies, the State Police and the Department of Public Health, are imposing real-time--or instantaneous computer access--requirements for their networks. The others postulate uses that do not call for instant access, and their data transmission needs can be handled as they arise on a dial-up basis over ordinary voice lines already in the network. As yet, no one is projecting high-speed computer-to-computer circuits.

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[*] This procedure is explained in detail in Section 1, Appendix C, Report A, pp. 409-19.

Table 4-3

1975 Voice Grade, Dial Access Line Requirements

	AIRLINE MILES	NORMAL		PRIORITY						TOTAL	
				STATE POLICE *		HIGHWAYS *		MENTAL HEALTH **			
		P-1	P-10	P-1	P-10	P-1	P-10	P-1	P-10	P-1	P-10
SPRINGFIELD TO:											
Albion	132	-	-	2	2	-	-	-	-	2	2
Alton	68	10	7	-	-	-	-	4	2	14	9
Anna	167	4	2	-	-	-	-	5	3	9	5
Aurora	148	4	3	-	-	-	-	-	-	4	3
Bloomington	58	12	9	-	-	-	-	-	-	12	9
Blue Island	164	-	-	4	3	-	-	-	-	4	3
Cairo	192	-	-	3	2	-	-	-	-	3	2
Carbondale	144	16	11	-	-	6	4	-	-	22	15
Centralia	96	-	-	-	-	-	-	4	2	4	2
Champaign	78	23	19	-	-	-	-	5	4	28	23
Chicago	174	126	115	-		9	7	19	15	154	137
Collinsville	78	13	10	5	3	-	-	3	2	21	15
Decatur	37	13	9	-	-	-	-	6	4	19	13
Des Plaines	170	3	2	4	2	-	-	-	-	7	4
Dixon	144	3	2	-	-	5	4	-	-	8	6
DuQuoin	126	3	2	4	2	-	-	-	-	7	4
East St. Louis	88	3	2	-	-	7	5	-	-	10	7
Edwardsville	72	5	4	-	-	-	-	-	-	5	4
Effingham	76	3	2	-	-	5	3	-	-	8	5
Elgin	172	11	8	4	3	7	5	-	-	22	16
Galesburg	90	3	2	-	-	-	-	4	2	7	4
Germantown	66	-	-	4	2	-	-	-	-	4	2
Harrisburg	156	-	-	-	-	-	-	4	3	4	3
Hinsdale	160	6	4	3	2	-	-	-	-	9	6
Jacksonville	34	8	5	-	-	-	-	6	4	14	9
Joliet	143	9	6	4	3	-	-	-	-	13	9
Kankakee	132	5	3	2	2	-	-	-	-	7	5
Lincoln	24	7	5	-	-	-	-	7	4	14	9
Litchfield	46	4	2	3	2	-	-	-	-	7	4
Macomb	72	5	3	4	2	-	-	-	-	9	5
Menard	132	-	-	-	-	-	-	4	2	4	2
Ottawa	116	6	4	-	-	7	5	-	-	13	9
Paris	106	-	-	-	-	7	5	-	-	7	5
Pecatonica	173	-	-	2	2	-	-	-	-	2	2

Table 4-3

(Continued)

	AIRLINE MILES	NORMAL		PRIORITY						TOTAL	
				STATE POLICE *		HIGHWAYS *		MENTAL HEALTH **			
		P-1	P-10	P-1	P-10	P-1	P-10	P-1	P-10	P-1	P-10
SPRINGFIELD TO: (Continued)											
Peoria	66	20	16	–	–	5	4	5	3	30	23
Peru	108	–	–	3	2	–	–	–	–	3	2
Pesotum	71	–	–	5	3	–	–	–	–	5	3
Pittsfield	66	–	–	3	2	–	–	–	–	3	2
Pontiac	90	3	2	4	3	–	–	–	–	7	5
Rock Island	126	9	7	4	3	–	–	–	–	13	10
Rockford	174	8	6	–	–	–	–	–	–	8	6
Quincy	96	6	4	–	–	–	–	–	–	6	4
Sterling	136	3	2	4	3	–	–	–	–	7	5
Watson	78	–	–	3	2	–	–	–	–	3	2
Total		354	278	74	50	58	42	76	50	562	420
CHICAGO TO:											
Aurora	36	5	3					–	–	5	3
Bloomington	114	4	3					–	–	4	3
Carbondale	288	4	2					–	–	4	2
Champaign	115	49	43					–	–	49	43
Decatur	145	3	2					–	–	3	2
De Kalb	54	11	9					–	–	11	9
Dixon	100	3	2					4	3	7	5
Dwight	63	–	–					3	2	3	2
East Moline	152	–	–					3	2	3	2
East St. Louis	258	3	2					–	–	3	2
Edwardsville	240	3	2					–	–	3	2
Elgin	42	10	8					6	5	16	13
Joliet	36	6	5					–	–	6	5
Kankakee	48	4	3					5	3	9	6
Macomb	186	3	2					–	–	3	2
Manteno	39	3	2					6	4	9	6
Peoria	129	4	3					–	–	4	3
Rockford	90	4	3					4	3	8	6
Tinley Park	20	–	–					4	3	4	3
Total		115	94					35	25	150	119

Table 4-3

(Continued)

	AIRLINE MILES	NORMAL		PRIORITY						TOTAL	
				STATE POLICE*		HIGHWAYS*		MENTAL HEALTH**			
		P-1	P-10	P-1	P-10	P-1	P-10	P-1	P-10	P-1	P-10
CHAMPAIGN TO:											
Bloomington	50	6	4							6	4
Carbondale	174	4	3							4	3
Danville	33	6	5							6	5
Decatur	42	7	5							7	5
Total		23	17							23	17
EDWARDSVILLE TO:											
Alton	12	19	15							19	15
Carbondale	84	23	19							23	19
East St. Louis	18	41	35							41	35
Total		84	69							84	69
GRAND TOTAL		575	458	74	50	58	42	111	75	818	625

*State Police and Highways systems are connected to Springfield.

**Mental Health system is connected to Springfield and/or Chicago.

Table 4-4

1975 State Agency Data System Requirements

AGENCY	COMPUTER TYPE AND LOCATION	APPLICATION	HOURS & DAYS OF USE	RESPONSE TIME	LINE REQUIREMENT	TYPE TERMINAL	SCHEDULE
Secretary of State Drivers License	Burroughs 6500 Centennial Bldg.	Process drivers license from exam stations statewide	8 hrs/6 days per week	1 minute	50/50 dedicated and dial up	Teletype 2-way	Complete 1972
Library	No info. avail.	Document retrieval	8 hrs/5 days	Not critical	Not known	Teletype	1975
Public Aid	360/40/256K 6th Flr. State Office Bldg.	Medical applications and payments	8 hrs/5 days	Not critical	Dial up 102 in WATS 50-FX-Cook Cty. 55-Springfield	Teletype 2-way	Fall 1969 start
Personnel	360/30 6th Flr. State Office Bldg.	Personnel transactions (60,000 Code Employees)	8 hrs/5 days	Not critical	Dial-up	Teletype	8 locations--1969 plus 44--1971
Mental Health	360/50 4th Flr. State Office Bldg. Future--7th Flr.	Personnel payroll, patient data, inventory and drug control	8 hrs/5 days	Not critical	Dial-up	Teletype 2-way	1970
Public Health	360/30 6th Flr. State Office Bldg.	Air pollution telemetering. Also labs in Chicago to Springfield	24 hrs/7 days	None	Dedicated	Sensor--under development 1 way	1969
Police	360/40 5th Flr. Armory	Total law enforcement, real-time. Simultaneous transmission rqmt.	24 hrs/7 days	Seconds	Dedicated	Teletype 1050 IBM terminals	27 state police locations 1969. Balance 1971 (Over 300 Total)
Highways	360/40 Jan.69 Location unknown	Time data, man hours, project status. Engr. computational system (Fortran)	8 hrs/5 days plus some off hours	Not critical	Dial-up	Teletype	1972
Revenue	Not known. 6th Flr. State Office Bldg.	Tax audit. Possible state income tax. Small Inquiry--large response	8 hrs/5 days	Minutes	2-way dial-up, Possibly dedicated later if volume increases	Teletype. Traveling auditors have mobile terminal requirement	Late 1969. Develop until 1972.
Higher Education	Springfield location unknown	Tie all 4-yr schools together	8 hrs/5 days	Not critical	Dial up	Teletype	1975

SOURCE: Data supplied at a meeting of SDC and State agency representatives in Springfield, Illinois, October 21, 1968.

Table 4-5 summarizes 1975 line requirements for the State's data networks. Lines are specified as either dedicated or dial-up and are arranged by sponsoring agency and location of the remote terminals. A dial-up terminal utilizes a device such as a data set* to transmit data over ordinary voice lines. Dial-up data terminals are preferred because of their lower cost and are used where they are adequate to handle the low volume, non-urgent traffic most of the agencies now expect to transmit in their systems. The dedicated circuit, however, consists of a keyboard device connected full time to a central computer by lines used only for that purpose. Remote terminals, in either mode of operation, will access central computers in Springfield.

Dedicated lines, with seven exceptions, are projected for all cities now on intercity voice corridors to Springfield. (These corridors were shown earlier in Table 4-2.) The basis for this projection is that these channels will become the major data corridors by 1975, and volume of data traffic will make it economically desirable to add dedicated lines. With common carrier bulk rates (Telpak), dedicated data lines can be added for about one-fourth the cost of voice lines. Seven terminal locations where such economy will not be possible are De Kalb, Elmhurst, Granite City, Johnson City, La Salle, Moline, and Waukegan. None of these cities is on a major voice corridor to Springfield, but all seven are designated by Public Health as the initial terminals for a Public Health air sampling program which requires on-line (direct) round-the-clock access to the computer. Hence, there is a requirement for dedicated lines.

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*A data set converts electrical impulses--from a teleprinter or computer--into audio tones that can be transmitted over ordinary telephone lines. The technique is similar to placing a routine telephone call.

Table 4-5

1975 Projected Data Line Requirements

	DRIVERS LICENSE		PUBLIC AID		PERSONNEL (SPAN)		MENTAL HEALTH		PUBLIC HEALTH		POLICE (LEADS)		S.O.S. LIBRARY		HIGHER ED.		HIGHWAYS		REVENUE		TOTAL	
	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.
Albion		1		1								1										3
Aledo	1		1																		2	
Alton		1		1		1		1		1												5
Amboy	1																				1	
Anna				1		1		1														3
Aurora		1		1						1												3
Beardstown			1																		1	
Belleville	1		1										1								3	
Belvidere	1		1																		2	
Benton	1		1																		2	
Bloomington		1		1						1				1								4
Blue Island												1										1
Cairo		1		1								1										3
Cambridge	1																				1	
Carbondale		1		1		1								1		1		1				6
Carlinville	1		1																		2	
Carlyle	1		1																		2	
Carmi	1		1																		2	
Carrollton	1		1																		2	
Carterville															1						1	
Carthage	1		1																		2	
Centralia		1		1		1		1		1												5
Chadwick	1																				1	
Champaign		1		1				1		1				2		1						7
Charleston	1		1												1						3	
Chester	1		1																		2	
Chicago		3		50		5		14		9		1		1		6		1		1		91
Christopher	1																				1	
Clinton	1		1																		2	
Collinsville												1										1
Danville	1		1																1		3	
Decatur		1		1				1		1				1								5
De Kalb	1									1					1						2	1
Dixon		1		1		2		1		1								1				7
DuQuoin		1		1								1										3
Dwight							1														1	
E. Dubuque	1																				1	
E. Moline			1		1		1														3	
E. St. Louis		1		1		1		1		3								1		1		9
Edwardsville		1		1										1		1						4

Table 4-5

(Continued)

	DRIVERS LICENSE		PUBLIC AID		PERSONNEL (SPAN)		MENTAL HEALTH		PUBLIC HEALTH		POLICE (LEADS)		S.O.S. LIBRARY		HIGHER ED.		HIGHWAYS		REVENUE		TOTAL	
	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.
Effingham		1		1		1						1						1				5
Elgin		1				2		1		1		1						1				7
Elizabethtown	1		1																		2	
Elmhurst										1												1
Eureka			1																		1	
Fairfield	1		1																		2	
Flora	1												1								2	
Freeport	1		1																		2	
Galena	1		1																		2	
Galesburg		1		1		1		1														4
Geneva	1																		1		2	
Germantown												1										1
Gibson City	1																				1	
Golconda	1		1																		2	
Granite City	1									1											1	1
Granville			1																		1	
Greenville	1		1																		2	
Hardin	1		1																		2	
Harrisburg		1		1		1		1														4
Havana	1		1																		2	
Hennepin	1																				1	
Henry			1																		1	
Herrin													1								1	
Highland	1																				1	
Hillsboro	1		1																		2	
Hinsdale												1										1
Hoopeston	1																				1	
Jacksonville		1		1		1		1														4
Jerseyville	1		1																		2	
Johnston City										1												1
Joliet		1		1		1				1		2		1								7
Jonesboro	1																				1	
Kankakee		1		1		1		1		1		1										6
Kewanee	1		1																		2	
Lacon	1																				1	
La Salle	1									1											1	1
Lawrenceville	1		1																		2	
Libertyville	1																				1	
Lincoln		1		1		1		1														4
Litchfield		1										1										2

Table 4-5
(Continued)

	DRIVERS LICENSE		PUBLIC AID		PERSONNEL (SPAN)		MENTAL HEALTH		PUBLIC HEALTH		POLICE (LEADS)		S.O.S. LIBRARY		HIGHER ED.		HIGHWAYS		REVENUE		TOTAL	
	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.
Louisville			1																		1	
Lewiston	1		1																		2	
Lombard	1																				1	
McLeansboro	1		1																		2	
Macomb		1		1								1				1						4
Manteno					1		1														2	
Marion	1		1																1		3	
Marshall	1		1																		2	
Mattoon	1																				1	
Menard						1		1														2
Metropolis	1		1																		2	
Moline	1									1			1								2	1
Monmouth	1		1										1								3	
Monticello	1		1																		2	
Morris	1		1																		2	
Morrison	1		1																		2	
Morton Grove													1								1	
Mounds			1																		1	
Mt. Carmel	1		1																		2	
Mt. Carroll			1																		1	
Mt. Sterling	1		1																		2	
Mt. Vernon	1		1																		2	
Murphysboro	1		1																		2	
Nashville	1		1																		2	
Newton	1		1																		2	
Normal															1						1	
Olmstead	1																				1	
Olney	1		1																		2	
Oquawka	1		1																		2	
Oregon	1		1																		2	
Ottawa		1		1		1								1				1				5
Pana	1																				1	
Paris		1		1		1												1				4
Paxton			1																		1	
Pecatonica												1										1
Pekin	1		1																		2	
Peoria		1		1		2		1		1				1				1				8
Peru												1										1
Pesotum												1										1
Petersburg	1		1																		2	

Table 4-5

(Continued)

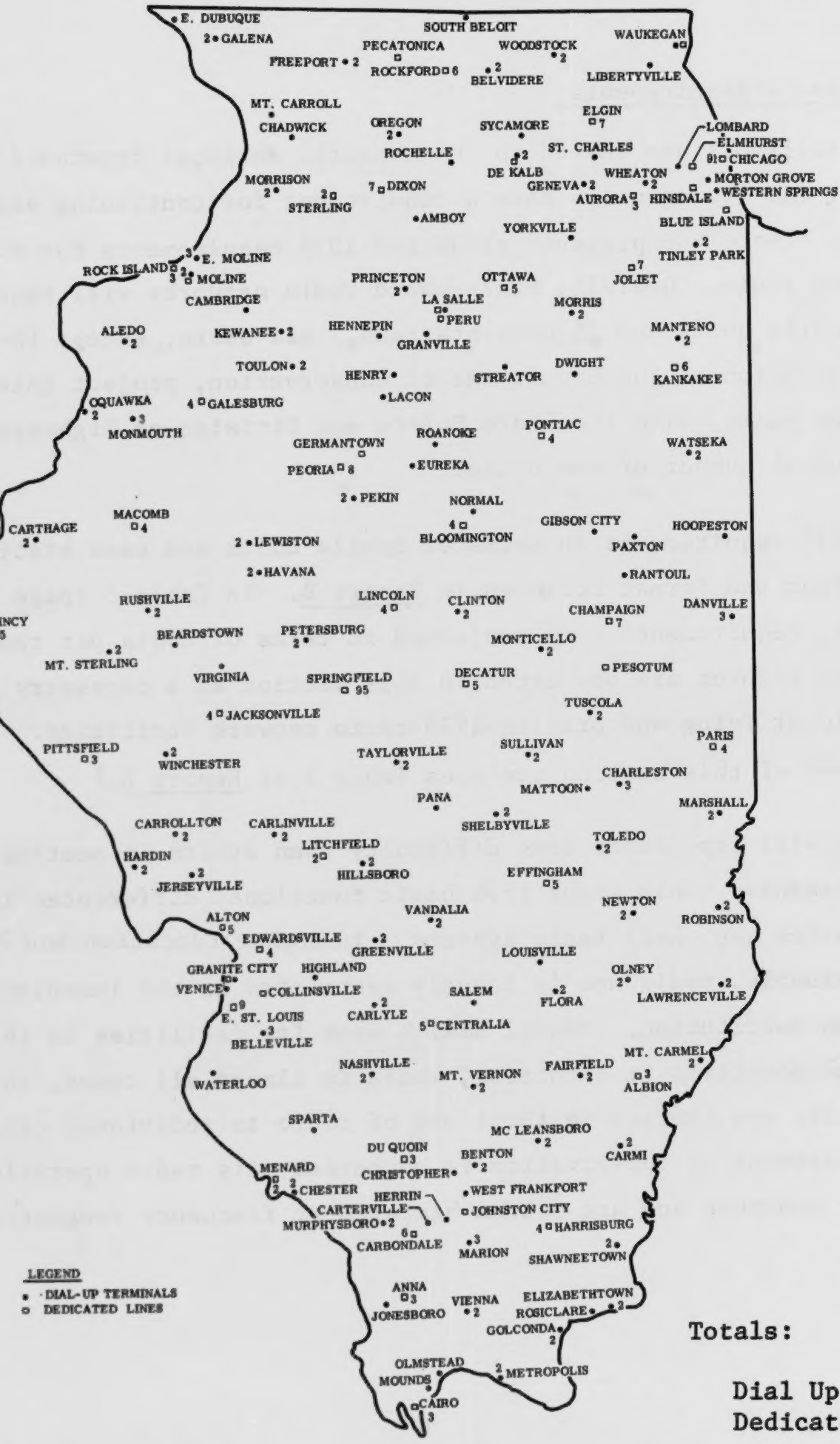
	DRIVERS LICENSE		PUBLIC AID		PERSONNEL (SPAN)		MENTAL HEALTH		PUBLIC HEALTH		POLICE (LEADS)		S.O.S. LIBRARY		HIGHER ED.		HIGHWAYS		REVENUE		TOTAL	
	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.	Dial	Ded.
Pittsfield		1		1								1										3
Pontiac		1		1		1						1										4
Princeton	1		1																		2	
Quincy		1		1		1				1				1								5
Rantoul	1																				1	
Roanoke	1																				1	
Robinson	1		1																		2	
Rochelle	1																				1	
Rockford		1		1				1		1				1						1		6
Rock Island				1								1								1		3
Rosiclare	1																				1	
Rushville	1		1																		2	
St. Charles					1																1	
Salem	1																				1	
Shawneetown	1		1																		2	
Shelbyville	1		1																		2	
South Beloit	1																				1	
Sparta	1																				1	
Springfield		1		55		23		2		2		7		1		1		2		1		95
Sterling		1										1										2
Streator	1																				1	
Sullivan	1		1																		2	
Sycamore			1																		1	
Taylorville	1		1																		2	
Tinley Park					1		1														2	
Toledo	1		1																		2	
Toulon	1		1																		2	
Tuscola	1		1																		2	
Vandalia	1		1																		2	
Venice			1																		1	
Vienna	1		1																		2	
Virginia	1																				1	
Waterloo	1		1																		2	
Watseka	1		1																		2	
Waukegon	1		1							1											2	1
Western Springs													1								1	
West Frankfort	1		1																		1	
Wheaton			1										1								2	
Winchester	1		1																		2	
Woodstock	1		1																		2	
Yorkville	1		1																		1	
TOTAL	95	35	76	135	4	41	4	32		34		29	8	13	4	11		11	3	5	194	356

*Of the 95 terminals at Springfield, many are in the same buildings and even on the same floors as the central computers to which they are linked. For this reason, the Springfield terminals are not "remote" in the same sense as terminals in distant cities.

Dial-up terminals projected for 1975 include 109 locations that are outside the high-density voice corridors to Springfield. The terminals in these locations do not benefit from the heavy call volumes that generate bulk rates and make dedicated circuits economically feasible. In these areas, contact with Springfield will likely be achieved by accessing the nearest foreign exchange line to obtain a voice circuit. Figure 4-2 projects the 1975 data terminal requirements; dial-up and dedicated terminals are arranged by city of location.

The line requirements in Table 4-5 and terminal locations in Figure 4-2 represent the best projection that can be made from today's Agency plans. But the use of data transmission is one of the fastest growing telecommunications applications in State government operations and therefore has the most uncertainty in forecasting. All signs, both State and national, point to sharp increases in information traffic and experience at all levels of government has shown that requirements expand as agencies gain more familiarity with their computers. Increased volume of output, alternative ways of structuring agency tasks, and new techniques for exchanging data with outlying offices are a few of the changes computers have fostered. These long-range possibilities are a major influence on the projected 1975 line requirements for State data systems.

With these possibilities in mind, close coordination of data system requirements is mandatory to reduce expensive duplications of service and facilities. Attention must be given to methods for interagency sharing of computer networks so that the economies possible from such arrangements may be fully realized. Failure to anticipate future system uses has often resulted not only in costly system "patching," but also in less-than-optimum system performance. Steps toward comprehensive system planning and sound management were taken up in greater detail in part three.


E. DUBUQUE
2 GALENA
SOUTH BELOIT
WAUKEGAN
PECATONICA
WOODSTOCK 2
FREEPORT 2
ROCKFORD 6
2 BELVIDERE
LIBERTYVILLE
MT. CARROLL
ELGIN 7
CHADWICK
OREGON 2
SYCAMORE
LOMBARD
ELMHURST
91 CHICAGO
ROCHELLE
2 DE KALB
ST. CHARLES
MORTON GROVE
WESTERN SPRINGS
MORRISON 2
2 STERLING
7 DIXON
GENEVA 2
WHEATON 2
AURORA 3
HINSDALE
AMBOY
YORKVILLE
BLUE ISLAND
2 TINLEY PARK
3 E. MOLINE
ROCK ISLAND 2
3 MOLINE
PRINCETON 2
OTTAWA 5
7 JOLIET
CAMBRIDGE
LA SALLE
PERU
MORRIS 2
ALEDO 2
KEWANEE 2
HENNEPIN
GRANVILLE
MANTENO 2
TOULON 2
DWIGHT
6 KANKAKEE
HENRY
STREATOR
OQUAWKA 2
3 MONMOUTH
4 GALESBURG
LACON
PONTIAC 4
GERMANTOWN
ROANOKE
WATSEKA 2
PEORIA 8
EUREKA
2 PEKIN
NORMAL
CARTHAGE 2
MACOMB 4
4 BLOOMINGTON
GIBSON CITY
HOOPESTON
PAXTON
2 LEWISTON
2 HAVANA
RANTOUL
RUSHVILLE 2
LINCOLN 4
CLINTON 2
CHAMPAIGN 7
DANVILLE 3
QUINCY 5
BEARDSTOWN
PETERSBURG 2
MONTICELLO 2
2 MT. STERLING
PESOTUM
VIRGINIA
SPRINGFIELD 95
DECATUR 5
TUSCOLA 2
4 JACKSONVILLE
PARIS 4
PITTSFIELD 3
2 WINCHESTER
TAYLORVILLE 2
SULLIVAN 2
CHARLESTON 3
MATTOON
PANA
MARSHALL 2
2 SHELBYVILLE
CARROLLTON 2
CARLINVILLE 2
LITCHFIELD 2
TOLEDO 2
HARDIN 2
2 HILLSBORO
2 JERSEYVILLE
EFFINGHAM 5
NEWTON 2
2 ROBINSON
VANDALIA 2
ALTON 5
EDWARDSVILLE 4
2 GREENVILLE
LOUISVILLE
GRANITE CITY
HIGHLAND
VENICE
COLLINSVILLE
OLNEY 2
2 LAWRENCEVILLE
9 E. ST. LOUIS
2 CARLYLE
SALEM
2 FLORA
3 BELLEVILLE
5 CENTRALIA
MT. CARMEL 2
NASHVILLE 2
MT. VERNON 2
FAIRFIELD 2
3 ALBION
WATERLOO
SPARTA
MC LEANSBORO 2
DU QUOIN 3
BENTON 2
2 CARMI
CHRISTOPHER
MENARD 2
2 CHESTER
HERRIN
WEST FRANKFORT
CARTERVILLE
JOHNSTON CITY
MURPHYSBORO 2
4 HARRISBURG
6 CARBONDALE
3 MARION
2 SHAWNEETOWN
LEGEND
DIAL-UP TERMINALS
DEDICATED LINES
ANNA 3
JONESBORO
VIENNA 2
ELIZABETHTOWN
ROSICLARE 2
GOLCONDA 2
OLMSTEAD
MOUNDS
2 METROPOLIS
CAIRO 3

Totals:

Dial Up	194
Dedicated	356

Figure 4-2

1975 Projected Data Network and Remote Terminal Locations

Land Mobile Radio Requirements

The State of Illinois has shared in the dramatic national growth of land mobile radio, and its agencies face a requirement for continuing expansion through 1975. Table 4-6 presents projected 1975 requirements for those State agencies using radio. Overall, State-owned radio networks will require 652 additional mobile units and 36 base stations. All users, except the Law Enforcement Division of the Department of Conservation, project gains over the next seven years, with the State Police and Division of Highways leading the way in actual number of new units.

Presenting 1975 requirements in terms of mobile units and base stations is a departure from the format followed in Report B. In Table 5 (page 115) of that document, requirements were projected in terms of costs per radio-user agency. These figures are converted in this section as a necessary first step toward identifying and pricing 1975 radio network facilities. (In effect, then, Table 4-6 of this section replaces Table 5 of Report B.)

Some agencies will experience less difficulty than others in meeting their future requirements. This stems from basic functional differences in the ways the agencies use their radio systems. In Higher Education and Mental Health, for example, radio use is largely restricted to the immediate environs of an institution. Mental Health uses its facilities in the vicinity of the various hospitals it maintains, while in almost all cases, the colleges and universities are limited in their use of radio to individual campuses. Where the Department of Conservation is concerned, its radio operations are almost wholly nonurban and are seldom hampered by frequency congestion.

Table 4-6

1975 Radio Requirements for Major State Agencies

AGENCY	MOBILE UNITS 1968	1975	NET INCREASE	NUMBER OF BASE TRANSMITTERS 1968	1975	NET INCREASE	NET INCREASE (%) MOBILE	BASES
State Police	1200	1370	170	26	31	5	17	19
Division of Highways	1230	1500	270	14	28	14	22	100
Conservation								
Parks and Memorials	90	180	90	21	21	-	100	-
Law Enforcement	120	120	-	4	4	-	-	-
Forestry	95	103	8	12	15	3	89	25
Mental Health	68	93	25	17	29	12	37	71
Secretary of State	150	170	20	State Police Dispatched				
Higher Education (All)	73	142	69	5	7	2	95	40
TOTALS	3026	3678	652	99	135	36	22	36

This leaves the State Police, the Division of Highways, and the Secretary of State (SoS) as the principal long distance and high population density area users. SoS needs represent part of the requirements for the State Police, since SoS vehicles use State Police radio frequencies. The coming seven years pose critical problems for both the State Police and Division of Highways, problems that will be almost exclusively confined to their operations in the State's two major urban areas--Chicago and the Illinois portions of the St. Louis Standard Metropolitan Statistical Area (SMSA).

Civil Defense Requirements

As conceived in Illinois, Civil Defense (CD) encompasses all local and State government agencies, their total planning effort prior to an attack, their response both during and after an attack, and their planning and operation during a disaster. The primary role of the State Civil Defense Agency is to assist other agencies in carrying out their designated civil defense assignments. The Civil Defense Director is charged by law to make maximum use of existing State and local departments and personnel in responding to emergency situations. Offices and personnel of the various departments, in turn, are expected to furnish the Director and civil defense organizations their utmost cooperation.

Civil Defense, then, is unique because it delegates specific emergency responsibilities across political jurisdictions to local, State, and national agencies. Also, the Illinois Civil Defense Agency is a crucial element not only in the five-state Region Four Civil Defense area, but in the national system as well. Civil Defense telecommunications requirements in Illinois must reflect this wide interaction and be flexible enough to accommodate alterations in requirements at any and all levels. Since so many jurisdictions are involved, projecting future requirements for Civil Defense in the State is a task involving more uncertainty than determining the future telecommunications needs of agencies whose communications activities are largely internal and confined within State boundaries.

Construction of radio base stations in the State Emergency Operating Center (EOC) at Springfield and in the nine State-wide Mutual Aid Areas (MAA) is required to make possible comprehensive civil defense direction and control. The CD base stations should also be linked to State radio networks of those agencies with primary or support missions in time of emergency. These agencies include the State Police, the Division of Highways, and the Military and Naval Department. The Civil Defense base stations will operate on local government frequency 45.44 MHz, and installations should be equipped with remote control consoles as required. There is an additional need for at least 11 more mobile radio units for assignment to the MAAs. Auxiliary equipment is needed to allow the CD network to interface with State Police frequencies 42.50 MHz, 150 MHz, and with the nine channel CW. The Division of Highways is developing a support EOC that will eventually link CD with all Highways radio systems in the State. Work is either under way or in the planning stages on the State CD radio system described above. The CD timetable called for the State EOC-MAA network to include the EOC and five MAAs by the end of 1968. Linkage with the State Police and Division of Highways is projected by 1970. When completed, the radio network will supplant telephone as the primary CD direction and control system.

Both the State EOC and the MAAs require Radio Amateur Civil Emergency Service (RACES) radio equipment to provide a secondary direction and control network. The timetable established by the State Civil Defense Director shows 1970 as the target date for installation of the RACES system. There is also a requirement for Citizens Band (CB) radio capability identical to the RACES requirement. It is planned to install multichannel CB transceivers in the State EOC and MAAs as a reserve communications network. This work is set for completion during 1969.

In addition to basic radio requirements within the State, Civil Defense in Illinois has an immediate need to integrate the State EOC intercom system into the National Communications System I (NACOM I), a dedicated wire system linking

Springfield to Civil Defense Region Four headquarters in Battle Creek, Michigan. The Region Four Field Officer is now working with the common carrier to resolve this problem.

A long-range CD requirement calls for a computer at the State EOC. This machine will be linked directly to other computer facilities in Illinois where data are available on radiological equipment and monitoring, fallout measurements, shelters, stockpiles of critical medical and food supplies, damage assessment, and related information. The computer circuits should eventually provide direct and instantaneous access to these vital emergency planning and operational data.

During an emergency in Illinois, heads of departments and agencies are assigned specific communications responsibilities within the State EOC. A requirement now exists to provide sufficient trunk lines, telephone sets, and switchboard capacity to ensure swift and reliable communications for this large staff. System design must be flexible enough for expansion as needs increase.

There are a number of additional telecommunications and telecommunications-related requirements that must be met to bring Illinois CD capabilities to a full state of preparedness. These are listed below as deficiencies that the State Civil Defense Director regards in need of correction.

- Provision for closed circuit TV in the State EOC; if linked to the Statewide ETV channels, this would provide, by 1975, a means of displaying emergency information, such as situation developments and damage.
- Fallout protected areas for telephone switchboards, communications equipment, computers and emergency operating personnel in all State agencies.

- Emergency power sources for all State agencies in the event of commercial power failure. A 14-day fuel supply for operating in an emergency is also required.

- Warning receivers in all State agencies, for early receipt of warning.

- Radio equipment in the State EOCs, by 1970, for liaison with Illinois National Guard.

- Remote pickup unit from the State EOC to a protected radio station for entry into the Emergency Broadcast System.

Emergency and disaster plans in Illinois now give Civil Defense priority access to all State telecommunications services and facilities whenever the need arises. Should Illinois obtain a State-wide microwave network, whether purchased, leased, or provided by the common carrier, Civil Defense requirements would remain top-priority although they would differ under the respective ownership arrangements. In a common carrier administrative network, radio back-up systems described earlier would continue to be an absolute necessity. In a State-owned or leased network the requirement for redundant radio networks would be less critical.

Civil Defense requirements are given full consideration in the discussion of various network approaches presented in the following pages. The network systems are laid out and costed to include the operational needs of the State EOC and the nine MAAs.

ETV Requirements

In the process of conducting this study, discussions were held with dozens of representatives of educational institutions, educational television associations, national authorities, outside consultants and the office of the Superintendent of Public Instruction concerning the functional requirements and technical plans for an Illinois ETV system. Questionnaires were sent to the majority of the educators in the State who are involved with ETV. As noted in Report B (pp. 152-153), the uncertainty of response to questions concerning uses to which real-time Statewide ETV channels would be put was taken to be indicative that "no serious planning has begun regarding possible specific real-time uses for any network that may be developed for educational communications facilities within Illinois." Without inputs on the future use of the system, SDC was unable to determine the functional requirements for a Statewide network.

Although the parties contacted were vague on detailed requirements, they were anything but vague in their belief that a Statewide ETV distribution network was needed. They were unanimous in stating that a Statewide ETV network is required. With minor exceptions, those who were contacted indicated that the basic requirements for an ETV network are still best represented by the function and performance of the network developed in the Jansky and Bailey report.[6]

An examination of the Jansky and Bailey report disclosed that the broadcast coverage is excellent, the closed circuit distribution network is extensive, and the number of TV channels provided for should be adequate for several years to come. Particularly, where exact usage has not been predetermined, the State can refine its requirements through an evolutionary process involving experimentation with a real operational system. The Jansky and Bailey concept has considerable flexibility in this regard and can be adapted to most operational requirements that can be envisioned.

The decision was made, therefore, to accept the functional capability of the Jansky and Bailey report as representing the true requirements for the State. These requirements can be summarized as a need for a closed circuit ETV network to interconnect the 15 proposed UHF ETV broadcast transmitter sites with program studios at the six university campuses. The network should also provide connection points within reasonable reach of all local school districts in the State.

There are many possible uses for an ETV microwave network to enhance the existing and proposed local ETV broadcast and closed circuit systems. Some of the many activities that may be aided by the network are:

- Teaching of foreign languages, science, mathematics, social studies and music in the elementary schools, particularly in the third through the seventh grades, is an excellent utilization of a superior teaching talent where qualified instructors in these particular subject areas are in short supply.
- In-service teacher training and adult and vocational education is a major benefit.
- In the universities, television is a major on-campus and off-campus instructional resource.
- An important benefit would be the enhancement of junior college curricula with university produced courses for the purpose of relieving teacher shortages and upgrading the level of instruction.
- Television is adaptable to many specialized functions such as: providing credit courses to those physically unable to attend learning institutions, training disadvantaged individuals throughout the State, on-campus new student orientation, classroom observation for teacher training, and performance observation in many courses such as speech therapy, physical education, and dance.

- Monitoring the operation of campus "laboratory schools" as well as providing them with instructional material creates a need for two-way transmission of television program material at the institutions of higher learning. Closely allied to this is the growing support to public school districts by the universities, particularly in the distribution of new teaching methods as they develop.
- With the addition of the proper terminal equipment, an ETV network, because of its wide frequency band characteristics, can easily accommodate the other types of narrow band educational transmissions such as slow-scan video, high fidelity audio, telephone quality audio, teleprinter and digital data, and distribution of educational radio network programs.
- The low cost of adding voice grade channels for educational radio networking (as part of the ETV distribution system) could readily provide specialized sub-channel (SCA multi-plex) programming to teachers, doctors, nurses, and other professionals who require almost constant in-service training.

SDC recognizes the value of ETV in meeting the educational requirements of the State and endorses the principles of the Superintendent of Public Instruction's policy of furthering the use of ETV as an instructional tool. Some appreciation of the distribution of television programming material in terms of who originates the program, who receives it, the type of program material, and the time of day when this material would be distributed is shown in Table 4-7 which is reproduced directly from the Jansky and Bailey report [6] to the Superintendent of Public Instruction.

While the requirements for video channel distribution have been accepted as the same in 1968 and the near future as they were in 1964, the actual network design was updated to encompass the new technology and costs as well as the changes in the FCC regulatory climate that have taken place with the passage of time (see "ETV Microwave Network--State-Owned," next section).

Table 4-7

Material to be Exchanged on State-Wide Network

EDUCATIONAL FACILITY	ORIGINATE TO:	RECEIVE FROM:	TYPES OF MATERIAL:	HOURS OF NETWORK USE
Universities	Elementary and secondary schools		In-service teacher training	Daytime
			Elementary student instructional programs (art, music, science)	School hours
	Secondary schools		Guidance programs, library materials	Daytime
	Local school buildings or broadcast stations		Extramural instruction (for credit)	Early evening
	Junior colleges, other colleges and universities	Other colleges and universities	Major resource instructional programs for first year courses (and for upper levels)	School hours, late evening for taping
			Computer data, information retrieval, statistical data	Late evening "Off-hours"
			In-service teacher training, instructional specialities	Daytime
	Special groups Professional people, Farmers, housewives 4H, etc. Cultural groups, Police, fire, & C.D. General public	Interested industries, and government agencies	Professional refresher courses; graduate training; extension courses; music, art, drama and related programs; adult instruction and retraining; public relations; occupational courses.	Afternoons, early evening
	Other educational institutions	Other educational institutions	Printed information retrieval, accreditation and records materials	Daytime, late evening (off-hours)

Table 4-7

(Continued)

EDUCATIONAL FACILITY	ORIGINATE TO:	RECEIVE FROM:	TYPES OF MATERIAL	HOURS OF NETWORK USE
	Educational researchers	Public school districts	Administrative and statistical data (attendance, expenses, pupil records)	Daytime
		Libraries and research centers	Information retrieval	Daytime, late evening (off-hours)
Junior colleges	Other junior colleges and universities	Other junior colleges and universities	Student instructional programs, adult instruction and retraining	Evenings (and daytime)
			Administrative data, computer data for student instruction	"Off-hours"
			In-service teacher training	Daytime
		Interested industries, network, government agencies	Adult instructional and retraining programs	Afternoons, early evening
	Local high schools, Corrective institutions, Public (handicapped, "at-home", and dropouts)		Secondary and junior college student instructional programs, adult retraining	Daytime early evening
	Public		Adult education programs, cultural and community affairs	Afternoons, early evening
Elementary and secondary schools	Other nearby elementary and secondary schools, public		Elementary instructional programs, foreign language, parent-interest programs, public relations, community service	Daytime

Table 4-7

(Continued)

EDUCATIONAL FACILITY	ORIGINATE TO:	RECEIVE FROM:	TYPES OF MATERIAL	HOURS OF NETWORK USE
	Network center		Administrative data	School hours, "off-hours"
		Other schools, universities, tape centers (local and network)	Art, music, foreign language, and science student instructional programs, administrative and statistical data	Daytime
		Interstate (via network)	Programs from MPATI and other state networks or stations	Anytime
		Network	Program review and evaluation	Daytime, early evening
ETV broadcast stations (and local tape center)	Network and other ETV stations		"In-school" instructional programs, special interest programs	Daytime (prescheduled), late evenings (for exchange purposes)
	Public		Extension programs, parent-interest programs, junior college programs, public relations, extramural credit	Evenings (primarily)
	Elementary schools		In-service teacher training, student instructional programs, rescheduled programs	Daytime
	Network		Basic instructional programming, state culture and history, documentaries	Anytime, primarily daytime and early evenings
		Local area	Program production by students and community	Daytime, early evening

Table 4-7
(Continued)

EDUCATIONAL FACILITY	ORIGINATE TO:	RECEIVE FROM:	TYPES OF MATERIAL	HOURS OF NETWORK USE
Network TV tape facility and library	Any educational institution, public, network, out-of-state facilities			Anytime, (primarily school hours and "off-hours" for taping)
		Educational Institutions, out-of state sources (NET, MPATI)		Anytime
Interstate connection	Any educational institution		Student instruction (all levels), university exchanges	Anytime
	Other state networks	Other state networks	All types of materials	Anytime
		Big Ten universities	Graduate level and scientific information, seminars, data exchange	Anytime
Educational FM broadcast stations	Public	Network	Extension programs, instructional programs, community affairs programs, cultural programs, sports events	Daytime early evening

APPROACHES CONSIDERED

This section develops the feasible alternatives for two functionally different networks, both of which can be implemented alone or combined into a single network with multiple functions. The two functions are: (1) the distribution of ETV programs to ETV transmitters and educational institutions throughout the State, and (2) provision of intercity telephone and data traffic handling capability among the principal cities and towns in the State. The latter function includes both the large volume normal traffic generated by all State government agencies and the high priority circuits needed by such agencies as the State Police, Highways, and Civil Defense. The financing options considered include microwave, either owned outright by the state or leased from an independent company, and an equivalent service furnished by the telephone common carriers.

Insofar as possible the alternatives have been made to yield equivalent grades of service. They are, of course, not completely interchangeable in all respects. For example, a state-owned system would not be subjected to the type of labor union sabotage encountered in the recent strike against IBT where hundreds of cables were cut to cripple parts of the common carrier network. On the other hand, the state-owned system lacks the inherent flexibility of the common carrier service. Once installed, it is relatively fixed and can only be radically changed at great expense. Common carrier interexchange ETV channels are contracted for on a 12-month basis* so the system can be periodically revamped to conform to newer criteria without any major cost penalty.

The value to the State of these and other features peculiar to the networks considered is subjective in nature and indeterminate from a dollar value standpoint. No attempt has been made to place a dollar value on them, so they will only be discussed as criteria to aid in making a choice among alternatives where the variation in comparative costs is so small as to make the choice of a "best" system inconclusive. These subjective factors are covered in more detail in Part Five.

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*Source: IBT Tariff, see "ETV Network - Common Carrier" for specific rate discussion.

Four basic alternative plans for handling voice and data traffic were specified in the work statement (although later modified somewhat in discussions between the ITC and SDC). These were:

- Augmentation of current facilities through 1975 (POTS).
- Common carrier plan whereby all telecommunications services are provided by telephone company facilities.
- State-owned plan in which all telecommunications services, except local telephones, are owned by the State.
- State-leased plan whereby all telephone facilities, except local telephones, are leased from a non-common carrier company.

There were three ETV network options that were considered with each of the four administrative networks, making 12 possible combinations in all. These were:

- A State-Purchased Educational Television system.
- A State-Leased Educational Television system.
- A Common Carrier Educational Television system.

Some combinations were not feasible and were discarded after a minimum of discussion. An example is the common carrier administrative network plan which was impossible for SDC to cost. This plan is being prepared by IBT and its cost will probably be dependent upon "special" tariffs applied for by the telephone company and not disclosed to SDC. There is also no point in combining a state-owned administrative network with a leased ETV network or vice versa, as the method of financing is the only distinguishing feature between a state-owned and a leased system, and whichever financing method proves to be best for the state would be used for both.

The twelve considered plans can be represented by the following matrix:

ADMINISTRATIVE NETWORK OPTIONS	ETV NETWORK OPTIONS		
	Purchase	Lease	Common Carrier
Augmentation to 1975	(X)	(X)	(X)
Common Carrier	-	-	-
Purchased	(X)	-	(X)
Leased	-	(X)	(X)

Those combinations indicated by an (X) are considered to be feasible combinations of administrative and ETV networks. These seven combinations are compared and discussed in detail in Part Five. Details of the costing procedures are given in Appendix B.

In addition, CTAV and satellite distribution plans have been discussed as alternatives for the distribution of the administrative and ETV traffic. Where possible, representative costs for these plans are presented.

State ownership of an intercity telephone network implies that the network can be interconnected to the common carrier switching network. If it could not be interconnected it would have limited usefulness as only part of the state telephone traffic is carried on among state agencies. A large part of the traffic involves communications with the general public. If the general public could not be reached on the state network, then every state desk would have to have two instruments, one for calling people who are on the State network, and the other for people who are subscribers to the common carrier system. This is presently the situation that prevails with large power companies and others who have long had their own private telephone networks.

At this time, the issue of whether a State network can be interconnected with the common carrier switching system has not been fully resolved. In June 1968 the FCC made a ruling in the Carterfone Case[15] that, in effect, nullified all previous tariff provisions which prevented the interconnection of private systems with the common carrier facilities. According to that ruling, the burden of proof that a private system interconnection is harmful to the common carrier network is now placed on the common carrier. This means that any well-designed system must be accepted by the common carrier for interconnection to their system. In November 1968, the Bell and General telephone companies petitioned the Second U.S. Circuit Court of Appeals for a review of the FCC ruling.[14] They now have until January 31, 1969 to specify the parts of the Carterfone decision to which they object. The final ruling by the courts will take place sometime thereafter.

Under these circumstances, any recommendation for purchase of a State-owned system must include a caveat to the effect that the decision to purchase is dependent upon the outcome of the Federal Court's action on the telephone companies' petition.

As a practical matter, however, the case for the State-owned system is not that indeterminate. It is generally believed by those in the industry that the FCC ruling will stand up and that the telephone companies are fighting for a lost cause. Precedents, set over a considerable period of time, tend to substantiate that the trend is definitely for interconnection of private systems with the common carrier network. One of these precedents is in the State of Illinois where the toll highway system in Northern Illinois has a microwave network wholly owned by the Toll Highway Commission. This network provides many voice and data channels throughout the length and breadth of the system, and some of these microwave channels are terminated on a Toll Highway Commission PBX furnished by the Illinois Bell Telephone Company. These channels are used as incoming and outgoing trunks, and all parts of the Toll Highway network are regularly interconnected with the local and long distance trunks of the Illinois Bell Telephone System. This interconnection is known and has not been protested by the telephone company.

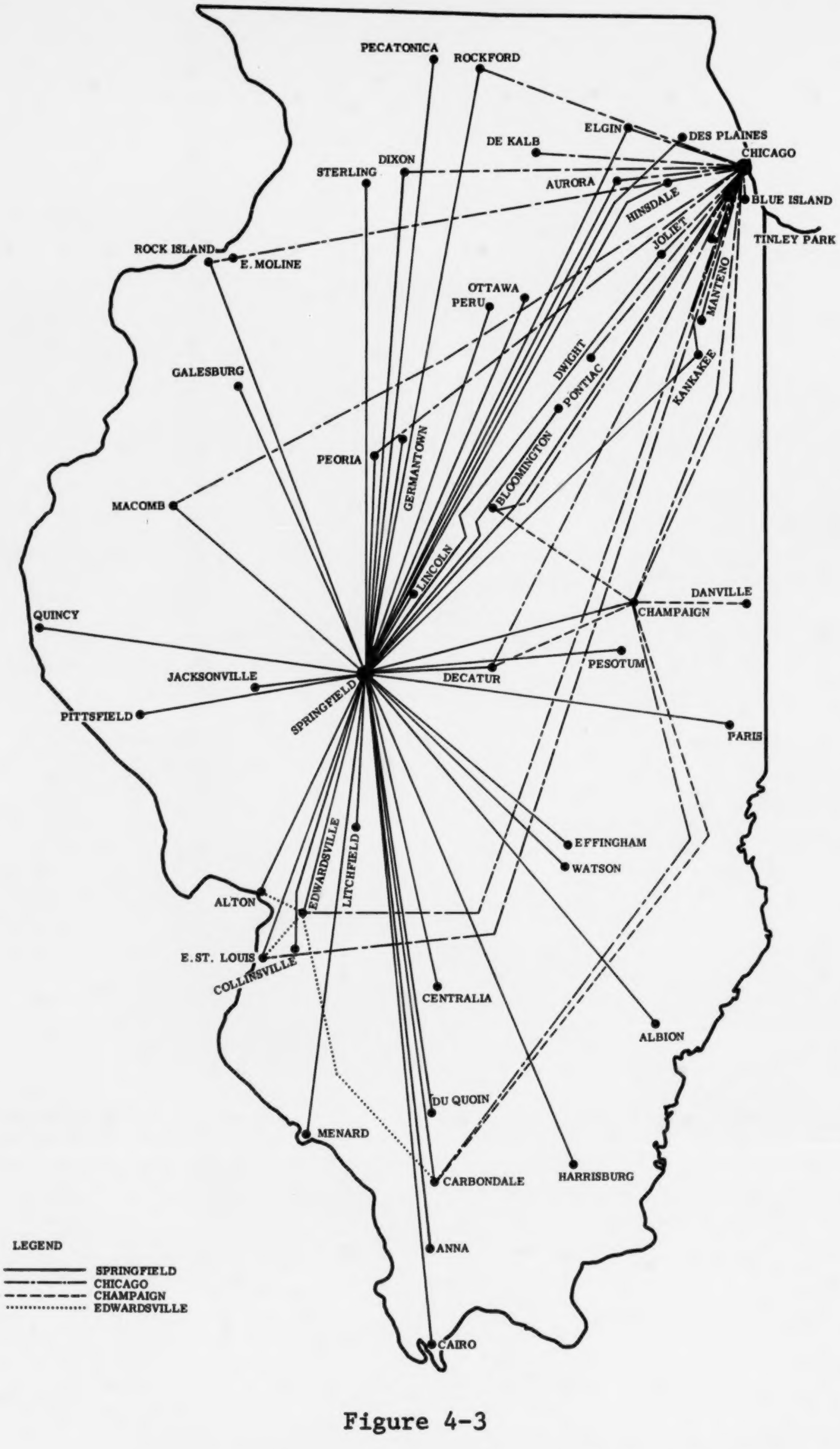
Administrative Network - Common Carrier POTS Facilities

This network plan is based on augmenting the present intercity common carrier system to accommodate 1975 requirements. This plan, referred to as POTS, illustrates what would happen if the State simply added facilities to meet additional demands without making any fundamental changes in the basic intercity system as it now exists. The 70 communication corridors and the telephone voice priority networks are shown in Figures 4-3 and 4-4, respectively. Current tariff rates are applied for costing purposes.

As most intercity lines are presently dial-accessed, and the 1975 network represents an augmentation of the present system, no consideration is given to operator-handled traffic. Further, the magnitude of 1975 traffic volumes would tend to make operator-handled traffic uneconomic.

It is assumed, however that some type of administrative control over access to the long distance trunks is necessary. In lieu of operator control it will be some type of automatic control. One type of control of dial-accessed lines is a procedure regulating access to a telephone system. For example, some stations might be restricted from calling any but local stations, while others might be given access to all network facilities. There are other intermediate station restriction options that could be exercised between these two extremes on a standard Centrex system.

Route Advance, now in effect in the Springfield Centrex, is another example of line access control. Under this procedure, a call is automatically switched to regular long distance lines without the knowledge of the calling party when the dedicated network is busy. Since these calls are billed separately, Route Advance helps to reduce unauthorized calls by providing spot check monitoring of the toll calls. It also provides a realistic measure of dedicated line requirements by inference from the size of the monthly toll bill. (If the toll charges are too high more dedicated lines are needed--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JOLIET
ROCK ISLAND
E. MOLINE
OTTAWA
PERU
MANTENO
DWIGHT
KANKAKEE
GALESBURG
PONTIAC
PEORIA
GERMANTOWN
BLOOMINGTON
MACOMB
LINCOLN
DANVILLE
CHAMPAIGN
QUINCY
PESOTUM
JACKSONVILLE
DECATUR
SPRINGFIELD
PITTSFIELD
PARIS
EFFINGHAM
WATSON
EDWARDSVILLE
LITCHFIELD
ALTON
E.ST. LOUIS
COLLINSVILLE
CENTRALIA
ALBION
DU QUOIN
MENARD
CARBONDALE
HARRISBURG
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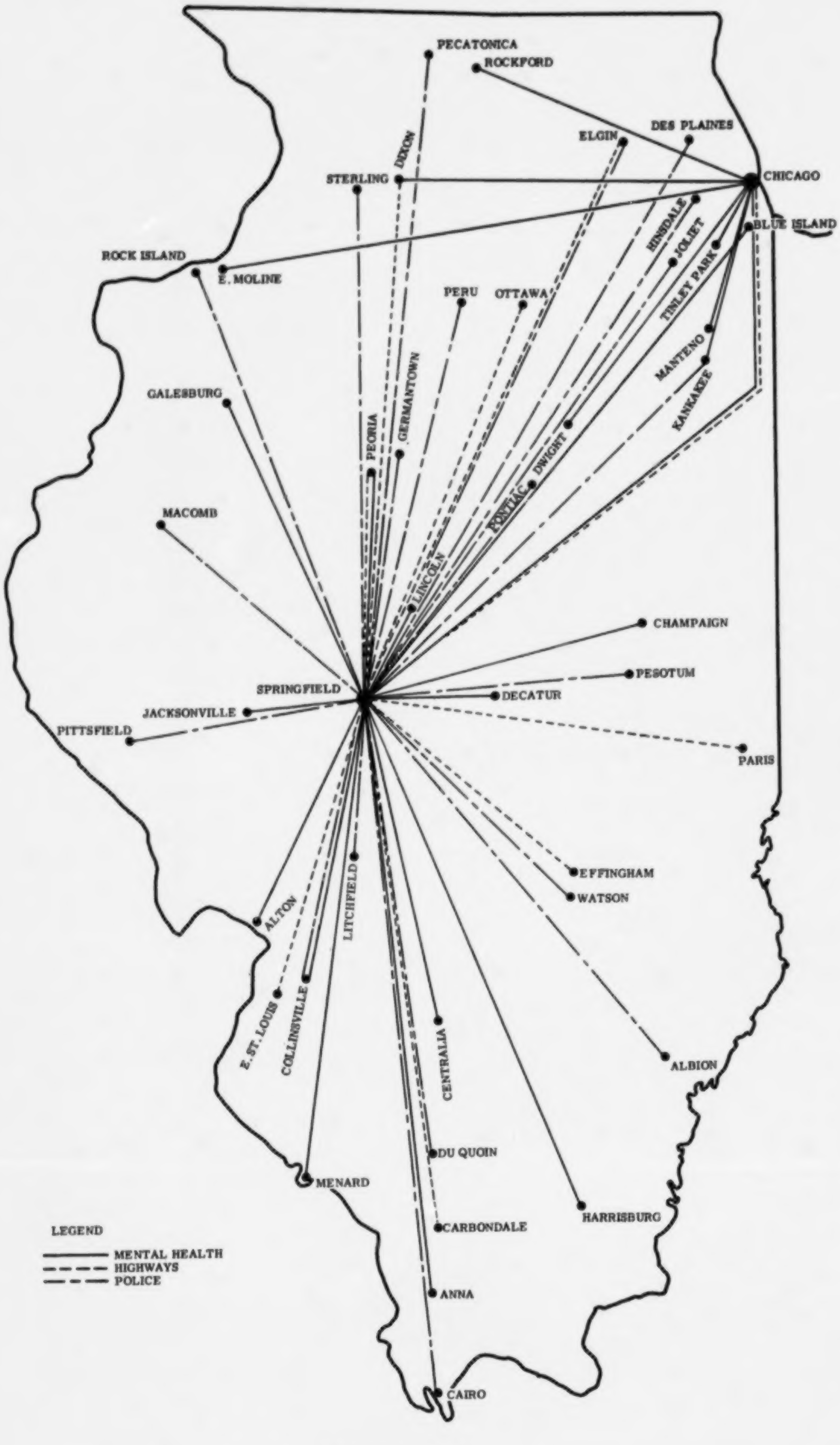
LEGEND
SPRINGFIELD
CHICAGO
CHAMPAIGN
EDWARDSVILLE

Figure 4-3

1975 Seventy Communication Corridors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PARIS
EFFINGHAM
WATSON
LITCHFIELD
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COLLINSVILLE
CENTRALIA
ALBION
DU QUOIN
MENARD
HARRISBURG
CARBONDALE
ANNA
CAIRO
LEGEND
MENTAL HEALTH
HIGHWAYS
POLICE

Figure 4-4

1975 Telephone Voice Priority Networks

if the charges are too low or non-existent more trunks are being leased than are needed to provide the required grade of service.)

Along with line control techniques, it is assumed that there will be a continuing effort to review billings with an eye toward minimizing toll traffic, maximizing use of dedicated lines, and eliminating unauthorized calling within the system. These management procedures, based on policy designed to maximize efficiency of the intercity network, are basic requirements in achieving economical balance between dedicated and toll facilities.

Table 4-8 converts line requirements, as shown previously in Table 4-3, into circuit mileages. Using an average figure of 76 cents per circuit mile (present average cost) as a base, annual telephone charges were projected for normal traffic and for priority traffic carried over separate subsystems utilized by the State Police, Division of Highways, and Department of Mental Health. For P-1 service, the annual cost is over $793,000; for P-10, charges are about $612,000. Data line costs, independent of grade of service, add another $71,880 to both computations. Data costs will be described in more detail below.

Table 4-9 presents a summary of projected monthly and annual costs for dedicated data lines. Not included here are the 95 data terminals assigned to Springfield. The exact locations of the Springfield terminals and computers are not now known, but with the concentration of State offices in Springfield total leased mileage within Springfield will be minimal and will not be a significant factor in the cost projections. The LEADS network is a different problem, since the State Police plan to use Western Union applies a uniform monthly charge of $230 per terminal, a package rate that includes both dedicated data line mileage and IBM terminal equipment leased costs. This method of billing is not comparable with the cost approach followed in projecting data line costs in this section. Total annual LEADS Costs, ($80,000) are applied later therefore in the total cost summary.

Table 4-8

1975 Voice Grade Lines and Circuit Mileages

		NORMAL				PRIORITY												TOTAL			
						STATE POLICE				HIGHWAYS				MENTAL HEALTH							
		P-1 GRADE		P-10 GRADE		P-1 GRADE		P-10 GRADE		P-1 GRADE		P-10 GRADE		P-1 GRADE		P-10 GRADE		P-1 GRADE		P-10 GRADE	
	AIRLINE MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES
SPRINGFIELD TO:																					
Albion	132	-	-	-	-	2	264	2	264	-	-	-	-	-	-	-	-	2	264	2	264
Alton	68	10	680	7	476	-	-	-	-	-	-	-	-	4	272	2	136	14	952	9	612
Anna	167	4	668	2	334	-	-	-	-	-	-	-	-	5	835	3	501	9	1503	5	835
Aurora	148	4	592	3	444	-	-	-	-	-	-	-	-	-	-	-	-	4	592	3	444
Bloomington	58	12	696	9	522	-	-	-	-	-	-	-	-	-	-	-	-	12	696	9	522
Blue Island	164	-	-	-	-	4	656	3	492	-	-	-	-	-	-	-	-	4	656	3	492
Cairo	192	-	-	-	-	3	576	2	384	-	-	-	-	-	-	-	-	3	576	2	384
Carbondale	144	16	2304	11	1584	-	-	-	-	6	864	4	576	-	-	-	-	22	3168	15	2160
Centralia	96	-	-	-	-	-	-	-	-	-	-	-	-	4	384	2	192	4	384	2	192
Champaign	78	23	1794	19	1482	-	-	-	-	-	-	-	-	5	390	4	312	28	2184	23	1794
Chicago	174	126	21924	115	20010					9	1566	7	1218	19	3306	15	2610	154	26796	137	23838
Collinsville	78	13	1014	10	780	5	390	3	234	-	-	-	-	3	234	2	156	21	1638	15	1170
Decatur	37	13	481	9	333	-	-	-	-	-	-	-	-	6	222	4	148	19	703	13	481
Des Plaines	170	3	510	2	340	4	680	2	340	-	-	-	-	-	-	-	-	7	1190	4	680
Dixon	144	3	432	2	288	-	-	-	-	5	720	4	576	-	-	-	-	8	1152	6	864
Du Quoin	126	3	378	2	252	4	504	2	252					-	-	-	-	7	882	4	504
E. St. Louis	88	3	264	2	176	-	-	-	-	7	616	5	440	-	-	-	-	10	880	7	616
Edwardsville	72	5	360	4	288	-	-	-	-	-	-	-	-	-	-	-	-	5	360	4	288
Effingham	76	3	228	2	152	-	-	-	-	5	380	3	228	-	-	-	-	8	608	5	380
Elgin	172	11	1892	8	1376	4	688	3	516	7	1204	5	860	-	-	-	-	22	3784	16	2752
Galesburg	90	3	270	2	180	-	-	-	-	-	-	-	-	4	360	2	180	7	630	4	360
Germantown	66	-	-	-	1 -	4	264	2	132	-	-	-	-	-	-	-	-	4	264	2	132
Harrisburg	156	-	-	-	-	-	-	-	-	-	-	-	-	4	624	3	468	4	624	3	468
Hinsdale	160	6	960	4	640	3	480	2	320	-	-	-	-	-	-	-	-	9	1440	6	960
Jacksonville	34	8	272	5	170	-	-	-	-	-	-	-	-	6	204	4	136	14	476	9	306
Joliet	143	9	1206	6	804	4	536	3	402	-	-	-	-	-	-	-	-	13	1742	9	1206
Kankakee	132	5	660	3	396	2	264	2	264	-	-	-	-	-	-	-	-	7	924	5	660
Lincoln	24	7	168	5	120	-	-	-	-	-	-	-	-	7	168	4	96	14	336	9	216
Litchfield	46	4	184	2	92	3	138	2	92	-	-	-	-	-	-	-	-	7	332	4	184
Macomb	72	5	360	3	216	4	288	2	144	-	-	-	-	-	-	-	-	9	648	5	360
Menard	132	-	-	-	-	-	-	-	-	-	-	-	-	4	528	2	264	4	528	2	264
Ottawa	116	6	696	4	464	-	-	-	-	7	812	5	580	-	-	-	-	13	1508	9	1044
Paris	106	-	-	-	-	-	-	-	-	7	742	5	530	-	-	-	-	7	742	5	530
Pecatonica	173	-	-	-	-	2	236	2	346	-	-	-	-	-	-	-	-	2	346	2	346
Peoria	66	20	1320	16	1056	-	-	-	-	5	330	3	264	5	330	3	198	30	1980	23	1518
Peru	108	-	-	-	-	3	324	2	216	-	-	-	-	-	-	-	-	3	324	2	216
Pesotum	71	-	-	-	-	5	355	3	213	-	-	-	-	-	-	-	-	5	355	3	213
Pittsfield	66	-	-	-	-	3	198	2	132	-	-	-	-	-	-	-	-	3	198	2	132
Pontiac	90	3	270	2	180	4	360	3	270	-	-	-	-	-	-	-	-	7	630	5	450
Quincy	96	6	576	4	384	-	-	-	-	-	-	-	-	-	-	-	-	6	576	4	384
Rockford	174	8	1392	6	1044	-	-	-	-	-	-	-	-	-	-	-	-	8	1392	6	1044
Rock Island	126	9	1134	7	882	4	504	3	378	-	-	-	-	-	-	-	-	13	1638	10	1260
Sterling	136	3	408	2	272	4	544	3	408	-	-	-	-	-	-	-	-	7	952	5	680
Watson	78	-	-	-	-	3	234	2	156	-	-	-	-	-	-	-	-	3	234	2	156
TOTAL		354	44093	278	35737	74	8593	50	5955	58	7244	42	5272	76	7857	50	5397	562	67787	420	52361

Table 4-8
(Continued)

		NORMAL				PRIORITY												TOTAL			
						STATE POLICE				HIGHWAYS				MENTAL HEALTH							
		P-1 GRADE		P-10 GRADE		P-1 GRADE		P-10 GRADE		P-1 GRADE		P-10 GRADE		P-1 GRADE		P-10 GRADE		P-1 GRADE		P-10 GRADE	
	AIRLINE MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES	LINES	CIRCUIT MILES
CHICAGO TO:																					
Aurora	36	5	180	3	108									-	-	-	-	5	180	3	108
Bloomington	114	4	445	3	342									-	-	-	-	4	456	3	342
Carbondale	288	4	1152	2	576									-	-	-	-	4	1152	2	576
Champaign	115	49	5635	43	4945									-	-	-	-	49	5635	43	4945
Decatur	145	3	435	2	290									-	-	-	-	3	435	2	290
De Kalb	54	11	594	9	486									-	-	-	-	11	594	9	486
Dixon	100	3	300	2	200									4	400	3	300	7	700	5	500
Dwight	63	-	-	-	-									3	189	2	126	3	189	2	126
E. Moline	152	-	-	-	-									3	456	2	304	3	456	2	304
E. St. Louis	258	3	774	2	516									-	-	-	-	3	774	2	516
Edwardsville	240	3	720	2	480									-	-	-	-	3	720	2	480
Elgin	42	10	420	8	336									6	252	5	210	16	672	13	546
Joliet	36	6	216	5	180									-	-	-	-	6	216	5	180
Kankakee	48	4	192	3	144									5	240	3	144	9	432	6	288
Macomb	186	3	558	2	372									-	-	-	-	3	558	2	372
Manteno	39	3	117	2	78									6	234	4	156	9	351	6	234
Peoria	129	4	516	3	387									-	-	-	-	4	516	3	387
Rockford	90	4	360	3	270									4	360	3	270	8	720	6	540
Tinley Park	20	-	-	-	-									4	80	3	60	4	80	3	60
TOTAL		119	12625	94	9710									33	2211	25	1570	154	14836	119	11280
CHAMPAIGN TO:																					
Bloomington	50	6	300	4	200									-	-	-	-	6	300	4	200
Carbondale	174	4	696	3	522									-	-	-	-	4	696	3	522
Danville	33	6	198	5	165									-	-	-	-	6	198	5	165
Decatur	42	7	294	5	210									-	-	-	-	7	294	5	210
TOTAL		23	1488	17	1097									-	-	-	-	23	1488	17	1097
EDWARDSVILLE TO:																					
Alton	12	19	228	15	180									-	-	-	-	19	228	15	180
Carbondale	84	23	1932	19	1596									-	-	-	-	23	1932	19	1596
E. St. Louis	18	41	738	35	630									-	-	-	-	41	738	35	630
TOTAL		83	2898	69	2406									-	-	-	-	83	2898	69	2406
GRAND TOTAL		579	61104	458	48950	74	8593	50	5955	[illegible]	7244	42	5272	111	10068	75	6967	822	87009	625	67144

*State Police and Highways systems are not connected to Chicago, Champaign and Edwardsville.

Table 4-9

1975 Dedicated Data Lines--Circuit Mileages and Monthly Cost

SPRINGFIELD TO:	MILES	DEDICATED LINES	CIRCUIT MILES	COST/MONTH @ $0.19/MI.
Albion	132	2	264	$ 50
Alton	68	5	340	65
Anna	167	3	501	95
Aurora	148	3	444	84
Cairo	192	2	384	73
Carbondale	144	6	864	164
Centralia	96	5	480	91
Champaign	78	7	546	104
Chicago	174	90	15,660	2,975
Decatur	37	5	185	35
De Kalb	155	1	155	29
Dixon	144	7	1,008	192
Du Quoin	126	2	252	4,788
E. St. Louis	88	9	792	150
Edwardsville	72	4	288	55
Effingham	76	4	304	58
Elgin	172	6	1,032	196
Elmhurst	170	1	170	32
Galesburg	90	4	360	68
Granite City	84	1	84	16
Harrisburg	156	4	624	119
Jacksonville	34	4	136	26
Johnson City	144	1	144	27
Joliet	143	5	715	136
Kankakee	132	5	660	125
La Salle	110	1	110	21
Lincoln	24	4	96	18
Litchfield	46	1	46	9
Macomb	72	3	216	41
Menard	132	2	264	50
Moline	124	1	124	24
Ottawa	116	5	580	110
Paris	106	4	424	81
Peoria	66	8	528	100
Pittsfield	66	2	132	25
Pontiac	90	3	270	51
Quincy	96	5	480	91
Rock Island	126	2	252	48
Rockford	174	6	1,044	199
Sterling	136	1	136	26
Waukegan	198	1	198	38
TOTAL		232	31,524	$ 5,990
ANNUAL COST (Cost Per Month x 12)				$71,880

Excluding the LEADS and Springfield terminals, then Table 4-9 provides cost information on 232 terminals located in 42 separate cities including Springfield. Following the same general costing procedure used for the inter-city voice network, monthly circuit costs have been calculated. The multiplier ($.19) is derived from the Telpak per mile rate for data lines, which is one-fourth the rate for voice lines. Since the average voice line cost is 76 cents per mile, the average cost for a data line was taken to be 19 cents per mile. Using 19 cents as a base, it is projected that the 232 dedicated data lines will cost $5,990 per month and $71,880 per year.

There is one final voice network requirement that must be discussed. This is for dedicated, full-time lines linking all transmitters in the Division of Highways, State Police, and Civil Defense radio networks to central EOCs in Springfield. Such linkage is mandatory, in SDC's judgement, to provide emergency back-up communications capability. The arrangement, called a radio control system, will allow either agency to access any or all radio transmitters in their networks simultaneously and exercise total direction and control from Springfield. The Division of Highways has put such a system into operation since publication of Report B.

In essence, voice lines used in this way provide a special system that is unlike either dial accessed or data networks. Circuit connections are between predetermined locations, and there is no way to access points off the system. Nor is there any dialing. Instruments--microphone, telephone set--are activated by a switch, a key, or simply by being lifted from the hook. These factors make radio control systems a practical equivalent of "hot line" systems.

Table 4-10 summarizes the emergency line radio control system costs.

The cost of present common carrier voice and data network projected to 1975 are presented in Table 4-11. Projections of toll charges and WATS line costs are not included. Toll in this case means intrastate long distance calls made

Table 4-10

1975 Emergency Voice Line Radio Control System Cost

SPRINGFIELD TO:	AIRLINE MILES	POLICE RADIO	HIGHWAY RADIO	CIVIL DEFENSE RADIO	TOTAL LINES	CIRCUIT MILES	COST/MONTH @ $0.76/MI.
Albion	132	1			1	132	$ 100
Blue Island	164	1			1	164	125
Cairo	192	1			1	192	146
Carbondale	144		1		1	144	109
Champaign	78			1	1	78	59
Chicago	174		1		1	174	132
Collinsville	78	1			1	78	59
Des Plaines	170	1			1	170	129
Dixon	144		1	1	2	288	219
Du Quoin	126	1			1	126	96
E. St. Louis	88		1		1	88	67
Effingham	76		1		1	76	58
Elgin	172	1	1		2	344	261
Germantown	66	1			1	66	50
Hinsdale	160	1			1	160	122
Joliet	143	1			1	143	109
Kankakee	132	1			1	132	100
Lawrenceville	133			1	1	133	101
Litchfield	46	1			1	46	35
Macomb	72	1			1	72	55
Milan	125			1	1	125	95
Ottawa	116		1		1	116	88
Paris	106		1		1	106	81
Pecatonica	173	1			1	173	131
Pekin	54			1	1	54	41
Peoria	66		1		1	66	50
Peru	108	1			1	108	82
Pesotum	71	1			1	71	54
Pittsfield	66	1			1	66	50
Pontiac	90	1			1	90	68
Quincy	96			1	1	96	73
Rock Island	126	1			1	126	96
Sterling	136	1			1	136	103
Swansea	90			1	1	90	68
Watson	78	1			1	78	59
West Frankfort	138			1	1	138	105
Wheaton	166			1	1	166	126
TOTAL		21	9	9	39	4,611	$3,504
ANNUAL COST (Cost per month X 12)							$41,476

Table 4-11. Present Common Carrier Voice and Data Network Costs

	P-1 GRADE			P-10 GRADE		
VOICE LINES:	CIRCUIT MILES	COST* PER MO.	ANNUAL COST	CIRCUIT MILES	COST* PER NO.	ANNUAL COST
NORMAL TRAFFIC	61,104	$ 46,439	$557,268	48,950	$ 37,202	$446,424
PRIORITY TRAFFIC						
STATE POLICE	8,593	6,531	78,372	5,955	4,526	54,312
HIGHWAYS	7,244	5,505	66,060	5,272	4,007	48,084
MENTAL HEALTH	10,068	7,652	91,824	6,967	5,295	63,540
TOTAL	87,090	66,127	793,524	67,144	51,030	612,360
DEDICATED DATA LINES						
TOTAL	31,524	5,990	71,880	31,524	5,990	71,880
TOTAL VOICE & DATA	118,533	72,117	865,404	98,668	57,020	684,240
RADIO CONTROL LINES EMERGENCY POLICE, HIGHWAY AND CIVIL DEFENSE						
TOTAL	4,611	3,504	41,476	4,611	3,504	42,048
GRAND TOTAL	123,144	$ 75,621	$906,880	103,279	$ 60,524	$726,288

*Cost per month per circuit mile is:

76¢ for voice lines
19¢ for data lines

State Police (LEADS) $80,000 per year

Springfield terminals excluded

outside the network--credit card, third-party, or collect long distance calls, for example. This kind of requirement, and its costs, will always be in addition to any intercity system. It is also postulated that any future dedicated network will require some WATS capability.

The reason for excluding projections for WATS costs is that present data make any future estimates extremely unreliable. It was made clear in Report A that the present intercity system is badly overloaded. On the basis of today's volume there is no way to measure the volume of excess WATS traffic. Because of this, there is now more WATS line traffic than there would be in an augmented network guaranteeing at least P-10 grade of service. With a guarantee of improved service in the augmented network, however, much WATS calling would be expected to divert to additional dedicated lines projected between major locations. Furthermore, providing dedicated lines to present low volume locations should bring about an even greater reduction in the use of the WATS service.

ETV Network - Common Carrier

The basic network on which the following cost considerations are based is that presented in the 1964 Jansky and Bailey (J&B) Report and described earlier under ETV requirements. This section supplies cost figures for a common carrier ETV system to meet the requirements posed by the J&B report.

In preparing future cost projections for the common carrier system, certain adjustments have been made in the J&B network. First of all, repeater stations are not included, since they have no bearing on the method by which the common carrier arrives at mileage costs. In any network, the common carrier bases tariffs on airline miles between terminal points without considering the actual route of the channels. The only access points on the network are at the 15 broadcast locations and the six university campuses designated as primary transmission points in the J&B report.

Another departure from the J&B report is that the SDC cost analysis is made for full color capability in the system. Jansky and Bailey postulated only black-and-white transmission, although they recommended color as a design goal. Since no tariff structure now exists for more than one ETV color channel, it has been necessary to base cost estimates on an adjustment of existing IBT black-and-white tariff rates. Discussions with IBT representatives indicate that a 15 percent upward adjustment of the multichannel black-and-white is a reasonable estimate for a color tariff. Such adjustment produces these comparative costs:

EXISTING BLACK-AND-WHITE RATE	ADJUSTED COLOR RATE
$27.50 first channel	$31.50 first channel*
12.20 second	14.00 second
12.00 third	14.00 third
10.00 fourth	11.50 fourth
10.00 fifth	11.50 fifth

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*Present Tariff

Table 4-12 summarizes cost projections for the common carrier ETV system. The number of channels between distribution points is the same as presented in the J&B study. Monthly costs are derived by multiplying the channel tariff by the distance in airline miles. Thus, the first color channel between Chicago and Kankakee costs $31.50 (tariff) x 48 (miles), or $1,512. This procedure produces monthly charges for all transmission channels in the system, and these were then totaled to provide total monthly system-wide costs--$70,914. Annual costs amount to $850,968, a figure some $50,000 less than arrived at by Jansky and Bailey.

Table 4-12

Common Carrier ETV System Cost (Jansky and Bailey Network)*

CHANNEL MILES	NO. OF CHANNELS	NETWORK SEGMENTS	DISTANCE AIRLINE MILES	CHANNEL 1 AT $31.50 PER MILE	CHANNEL 2 AT $14.00 PER MILE	CHANNEL 3 AT $14.00 PER MILE	CHANNEL 4 AT $11.50 PER MILE	CHANNEL 5 AT $11.50 PER MILE	TOTAL COST PER MONTH
192	4	Chicago - Kankakee	48	$ 1,512	$ 672	$ 672	$ 552	--	$ 3,408
288	4	Kankakee - Urbana	72	2,268	1,008	1,008	828	--	5,112
72	3	Urbana - Monticello	24	756	336	336	--	--	1,428
138	3	Monticello - Charleston	46	1,449	644	644	--	--	2,737
132	3	Charleston - Olney	44	1,386	616	616	--	--	2,618
228	3	Olney - Tamaroa	76	2,394	1,064	1,064	--	--	4,522
130	5	Tamaroa - Carbondale	26	819	364	364	299	$ 299	2,145
38	2	Carbondale - Goreville	19	599	266	--	--	--	865
248	4	Tamaroa - Edwardsville	62	1,953	868	868	713	--	4,402
78	3	Edwardsville - Carlinville	26	819	364	364	--	--	1,547
279	3	Carlinville - Macomb	93	2,930	1,302	1,302	--	--	5,534
86	2	Macomb - Quincy	43	1,355	602	--	--	--	1,957
24	2	Macomb - Macomb**	12	378	168	--	--	--	546
210	3	Macomb - Rock Island	70	2,205	980	980	--	--	4,165
234	3	Rock Island - Freeport	78	2,457	1,092	1,092	--	--	4,641
132	3	Freeport - De Kalb	44	1,386	616	616	--	--	2,618
162	3	De Kalb - Chicago	54	1,701	756	756	--	--	3,213
28	2	De Kalb - De Kalb**	14	441	196	--	--	--	637
171	3	De Kalb - Streator	57	1,796	798	798	--	--	3,392
150	3	Streator - Peoria	50	1,575	700	700	--	--	2,975
58	2	Peoria - Normal	29	914	406	--	--	--	1,320
80	2	Normal - Monticello	40	1,260	560	--	--	--	1,820
198	3	Peoria - Springfield	66	2,079	924	924	--	--	3,927
176	4	Springfield - Monticello	44	1,386	616	616	506	--	3,124
114	3	Springfield - Carlinville	38	1,197	532	532	--	--	2,261
3,646		TOTAL							$ 70,914
		ANNUAL COST (Cost per month X 12)							$850,968

* Transmitter and Studio Points Only, Color Rates Projected - IBT Tariff as Basis

** Studio to Transmitter circuits.

ETV Network - State-Owned Interconnection Network

SDC also updated the Jansky and Bailey[6] network to take into account the changes in FCC regulations that affect the network. It was found that the Jansky and Bailey proposal to operate in the 6-GHz band is now infeasible since there are insufficient channels available in Illinois in this frequency band. The only frequencies available at this time are in the 12-GHz band, which is, unfortunately, still somewhat experimental. However, there are some installations that have been made at this frequency so that there is experience to draw upon in designing a network.

The principal 12-GHz system now existing in the United States is a 13-hop system between Dallas and Houston, Texas, providing commercial television service. The operation of this channel by the Southwest CATV Company* has proven to be satisfactory in every respect. One drawback of the 12-GHz band is the requirement that repeater spacing be on the order of 20 miles or less; otherwise, unacceptable fades, particularly from rain, result. Since this spacing is much closer than the spacing used by Jansky and Bailey for their 6-GHz system, it has been necessary to add many relay stations to their basic Illinois network.

Figure 4-5 illustrates the Jansky and Bailey network with the new spacing and the new repeater stations added to satisfy the 12-GHz technical requirements. Most of the repeater stations specified in the Jansky and Bailey report were not primary channel breakout points, so in the process of redesign, many of these have been changed to other locations. A secondary purpose specified by Jansky and Bailey--providing a network connection within reasonable reach of any local school system in the state--has been preserved, however. In fact, with the new repeater spacing there are now 70 points of possible interconnection instead of the 33 in the original Jansky and Bailey network.

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*A subsidiary of Jerrold Electronics Corporation, Philadelphia, Pennsylvania

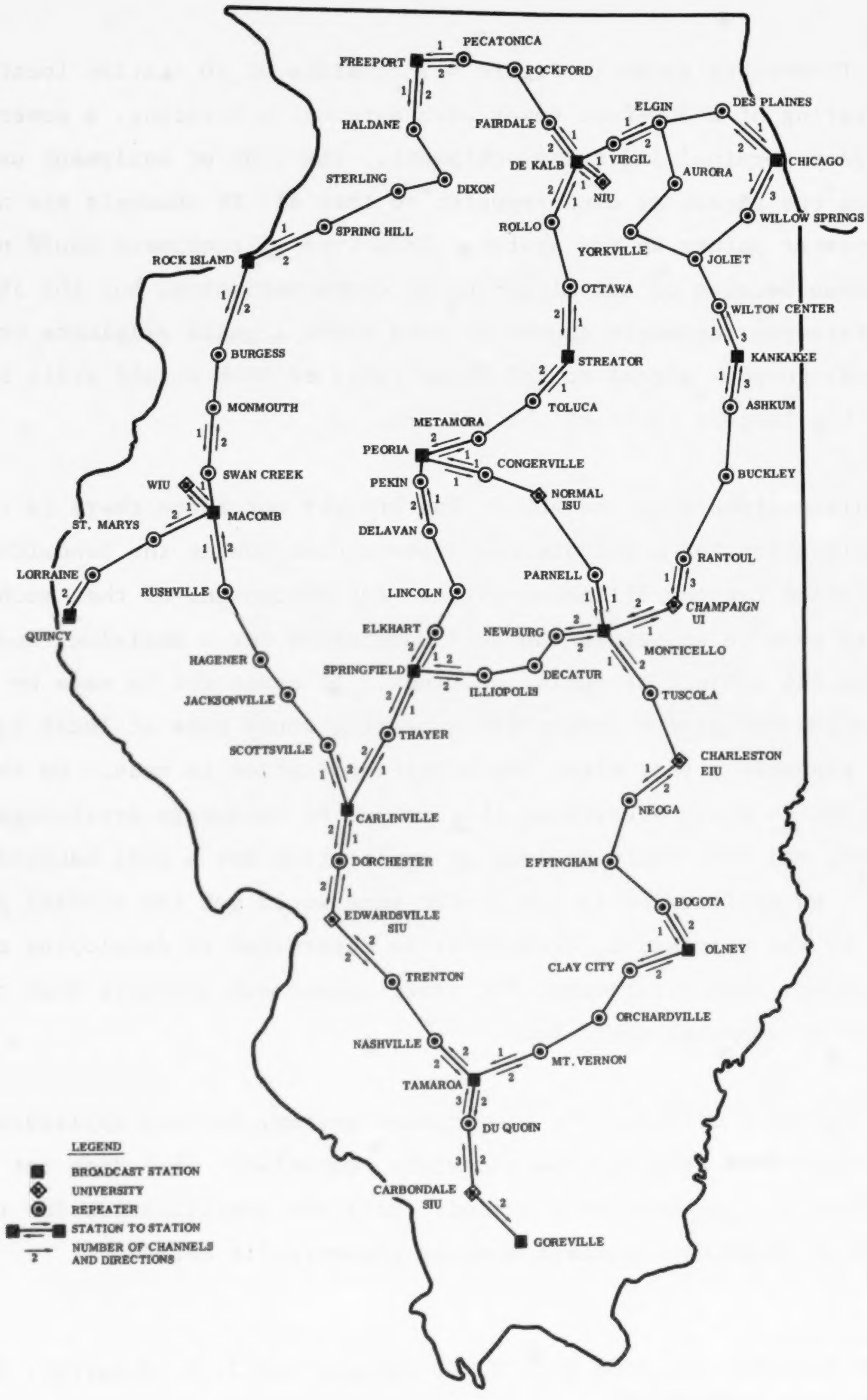
PECATONICA
FREEPORT
ROCKFORD
HALDANE
FAIRDALE
ELGIN
DES PLAINES
DE KALB
VIRGIL
CHICAGO
NIU
AURORA
STERLING
DIXON
WILLOW SPRINGS
SPRING HILL
ROLLO
ROCK ISLAND
YORKVILLE
JOLIET
OTTAWA
WILTON CENTER
BURGESS
STREATOR
KANKAKEE
MONMOUTH
TOLUCA
ASHKUM
METAMORA
PEORIA
CONGERVILLE
SWAN CREEK
PEKIN
WIU
NORMAL ISU
BUCKLEY
MACOMB
ST. MARYS
DELAVAN
LORRAINE
RANTOUL
RUSHVILLE
LINCOLN
PARNELL
QUINCY
CHAMPAIGN UI
ELKHART
NEWBURG
HAGENER
SPRINGFIELD
MONTICELLO
DECATUR
ILLIOPOLIS
JACKSONVILLE
TUSCOLA
THAYER
SCOTTSVILLE
CHARLESTON EIU
CARLINVILLE
NEOGA
DORCHESTER
EFFINGHAM
BOGOTA
EDWARDSVILLE SIU
OLNEY
CLAY CITY
TRENTON
ORCHARDVILLE
NASHVILLE
MT. VERNON
TAMAROA
DU QUOIN
CARBONDALE SIU
GOREVILLE
LEGEND
BROADCAST STATION
UNIVERSITY
REPEATER
STATION TO STATION
NUMBER OF CHANNELS AND DIRECTIONS

Figure 4-5

State-Owned ETV Microwave Network

The basic TV network shown in Figure 4-5 consists of 70 station locations, each consisting of a 300-foot tower with antenna, a building, a power supply, and necessary terminal and relay equipment. The type of equipment used demodulates the signal at each repeater so that all TV channels are accessible at all repeater points on the system. This type of equipment would normally not be chosen because of its higher noise characteristics, but the J&B recommended heterodyne repeaters cannot be used where signals originate or terminate. A video peak-to-peak signal to RMS noise ratio of 54db should still be available over the longest route of the network.

In SDC's discussions with the FCC it was brought out there there is no precedent for an application for a private microwave system having the bandwidth requirements specified for the Illinois system. Any assignment of that much spectrum space would have to go before the full Commission for a decision, and would probably be the subject of public hearings. It could not be made by an administrative decision. A Commission hearing would take at least six months and more, probably a year after the first application is made. On the other hand, the FCC is doing everything that it can to encourage development of the 12-GHz band, and they would welcome an application for a wide bandwidth from Illinois.* An application in the 12-GHz band would get the kindest possible treatment by the Commission, because it is interested in developing this area But since there is no precedent, FCC staff cannot now estimate what the probability of approval would be.

The State can be a licensee for a microwave system, but its application must prove the technical need for the bandwidth requested. This does not mean that justification for use must be provided. Only the justification for the actual facilities or bandwidth required must be presented in detail.

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*Interview November 14, 1968 with T. L. Johnson and J. C. McCarter, Federal Communications Commission.

One feature of the 12-GHz band is that there is no distinction made as to type of traffic sent over the microwave system. Educational TV program material can be intermixed with normal or priority voice or data circuits. One thing has become apparent, however; none of the towers presently owned or existing in the State can be used for the 12-GHz microwave system. They lack the rigidity necessary to constrain the angular movement of the antennas within the narrow limits that must be maintained to prevent deep fading. An antenna twist or sway of only ± 0.2 degree will result in a 10 db loss in signal strength.

There are, at present, seven 12-GHz systems operating in the State. One of these is operated in Chicago by Concordia College. There is a one-hop system located a few miles north of Peoria that is operated by the Caterpillar Corporation. Another one-hop 12-GHz system, near Quincy, is operated by the Quincy Cable TV Corporation, and a two-hop system is operated by the Danville CATV Company near the eastern border of the State, just below Kankakee. A one-hop east/west link is operated near Urbana by the Pontiac Cable TV Corporation. Another cable TV corporation operates a 40-mile system running southeast from Ottawa. All of these systems are short in range and, though some of them do intersect the postulated Jansky and Bailey network, it is not likely they would cause interference as there are plenty of frequencies available in this new 12-GHz band, i.e., frequency assignments should be no problem.

Table 4-13 lists the microwave sites and costs of equipment at each location. Table 4-14 summarizes the costs of the proposed State-owned Educational Television network.

Table 4-13

ETV 12-GHz Microwave System--Site Locations and Costs

LOCATION	LAND, TOWER, BLDG. 2	ANTENNAS @ $2,000 3	MICROWAVE RADIO EQUIPMENT 4	TOTAL 5
Ashkum	$ 23,500	$ 4,000	$ 28,900	$ 56,400
*Aurora				
*Bogota				
Buckley	23,500	4,000	28,900	56,400
Burgess	23,500	4,000	22,200	49,700
Carbondale	23,500	4,000	29,450	56,950
Carlinville	23,500	6,000	44,400	73,900
Champaign	23,500	8,000	42,450	73,950
Charleston	23,500	4,000	22,200	49,700
Chicago	23,500	4,000	27,700	55,200
Clay City	23,500	4,000	22,200	49,700
Congerville	23,500	4,000	14,450	41,950
Decatur	23,500	4,000	22,200	49,700
De Kalb	23,500	6,000	54,900	84,400
Delavan	23,500	4,000	22,200	49,700
Des Plaines	23,500	4,000	22,200	49,700
Dixon	23,500	4,000	22,200	49,700
Dorchester	23,500	4,000	28,900	56,400
Du Quoin	23,500	4,000	44,400	71,900
Edwardsville	23,500	4,000	28,900	56,400
*Effingham				
Elgin	23,500	4,000	22,200	49,700
Elkhart	23,500	4,000	22,200	49,700
*Fairdale				
Freeport	23,500	4,000	22,200	49,700
Goreville	23,500	2,000	11,000	36,500
Greenup	23,500	4,000	22,200	49,700
Hagener	23,500	4,000	22,200	49,700
Haldane	23,500	4,000	22,200	49,700
Illiopolis	23,500	4,000	22,200	49,700
Jacksonville	23,500	4,000	22,200	49,700
Joliet	23,500	4,000	28,900	56,400
Kankakee	23,500	4,000	28,900	56,400
Lincoln	23,500	4,000	22,200	49,700
Lindenwood	23,500	4,000	22,200	49,700
Lorraine	23,500	4,000	14,450	41,950
Macomb	23,500	8,000	32,200	63,700
Metamora	23,500	4,000	22,200	49,700
Milan	23,500	4,000	22,200	49,700
Monticello	23,500	8,000	42,450	73,950

Table 4-13
(Continued)

LOCATION	LAND, TOWER, BLDG.	ANTENNAS @ $2,000	MICROWAVE RADIO EQUIPMENT	TOTAL
Monmouth	$ 23,500	$ 4,000	$ 22,200	$ 49,700
Mt. Vernon	23,500	4,000	22,200	49,700
Myrtle	23,500	4,000	22,200	49,700
Nashville	23,500	4,000	28,900	56,400
*Neoga				
Newburg	23,500	4,000	22,200	49,700
Newton	23,500	4,000	22,200	49,700
NIU	23,500	2,000	10,500	36,000
Normal	23,500	4,000	14,450	41,950
Olney	23,500	4,000	22,200	49,700
Orchardville	23,500	4,000	22,200	49,700
Ottawa	23,500	4,000	22,200	49,700
Parnell	23,500	4,000	14,450	41,950
*Pecatonica				
Pekin	23,500	4,000	22,200	49,700
Peoria	23,500	6,000	32,700	62,200
Quincy	23,500	2,000	11,000	36,500
Rantoul	23,500	4,000	28,900	56,400
Rock Island	23,500	4,000	22,200	49,700
*Rockford				
Rollo	23,500	4,000	22,200	49,700
Rushville	23,500	4,000	22,200	49,700
Scottsville	23,500	4,000	22,200	49,700
Spring Hill	23,500	4,000	22,200	49,700
Springfield	23,500	6,000	44,400	73,900
St. Mary's	23,500	4,000	14,450	41,950
Sterling	23,500	4,000	22,200	49,700
Streator	23,500	4,000	22,200	49,700
Swan Creek	23,500	4,000	22,200	49,700
Tamaroa	23,500	6,000	52,150	81,650
Thayer	23,500	4,000	22,200	49,700
Toluca	23,500	4,000	22,200	49,700
Trenton	23,500	4,000	28,900	56,400
Tuscola	23,500	4,000	22,200	49,700
Willow Springs	23,500	4,000	28,900	56,400
Wilton Center	23,500	4,000	28,900	56,400
Virgil	23,500	4,000	22,200	49,700
WIU	23,500	2,000	10,500	36,000
*Yorkville				
TOTAL				$3,734,850

*Cities that would be included in the network if it were a combined system (ETV and administrative).

Table 4-14

Cost Summary for State-Owned ETV Interconnection Network
(12 GHz System)

Equipment and Installation	$3,734,850
15% Accessories and Spares Chicago, Springfield, Carbondale	27,908
5% Accessories and Spares Balance of Stations	177,440
GRAND TOTAL	3,940,198
INTEREST 5%	
Cost of Money - 5% for 15 Years Amortized to Pay Off in 15 Years	1,753,787
MAINTENANCE	
10% per Year	5,910,300
LOST TAXES	
2.5% per Year	835,321
TOTAL 15 YEAR LIFE	12,439,606
ANNUAL COST	$829,307

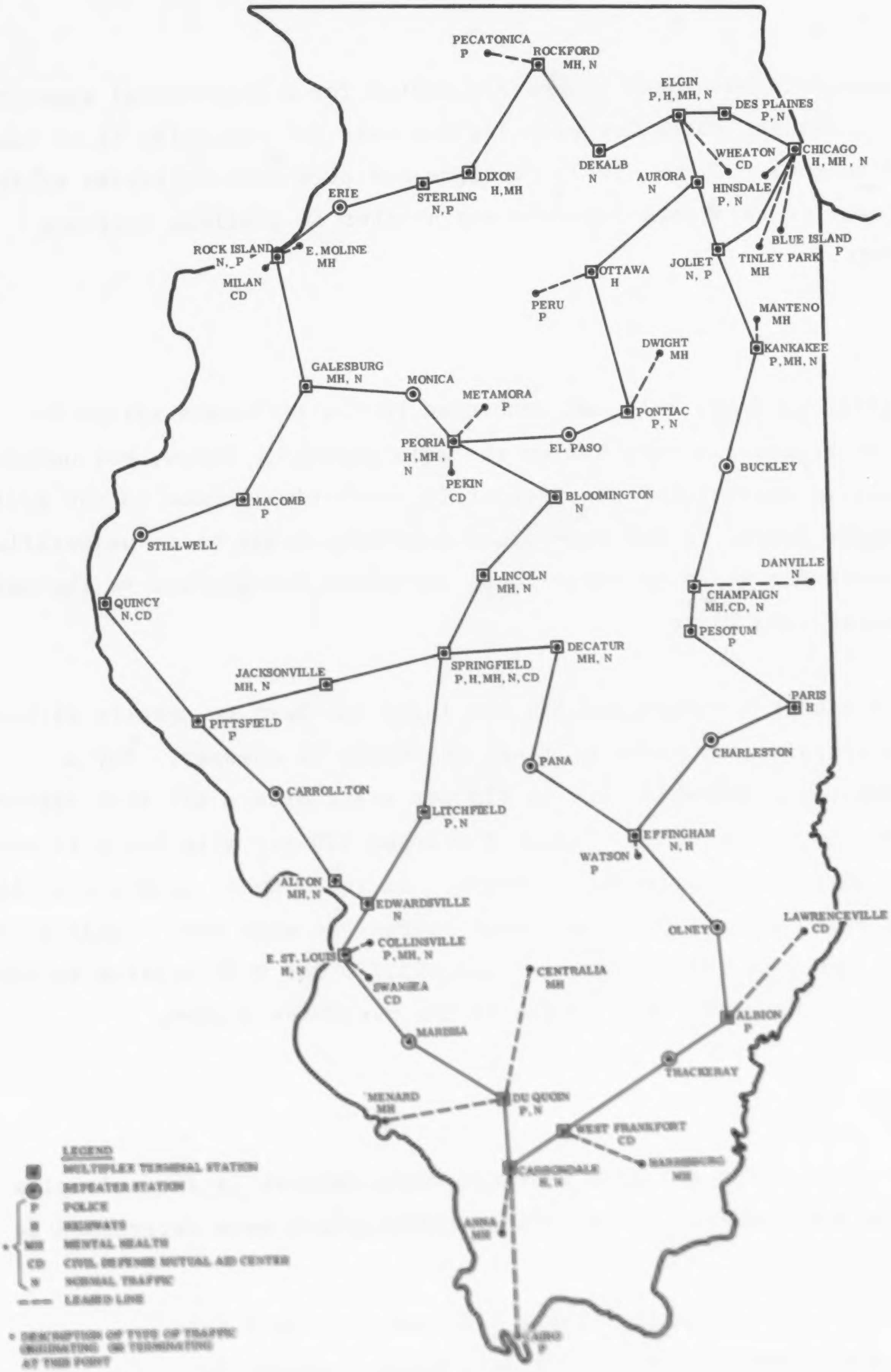
Administrative Network--State-Owned

A State-owned administrative network is a feasible alternative should Illinois decide to have no ETV network at all or to contract for such a service with the common carrier. The major influence behind consideration of a State-owned administrative system is the stated emergency and priority requirements of the State Police, the Division of Highways, and the Civil Defense Agency. There are also operational considerations for the Department of Mental Health, Illinois' largest noneducational agency. Priority requirements are dealt with in detail in sections on voice and data requirements, and in the common carrier augmented voice and data system.

The above agencies have repeatedly and forcefully expressed their desire to be free of common carrier facilities. The agencies regard such facilities as too easily vulnerable to vandalism or sabotage and therefore, of questionable reliability in time of civil emergency or disaster. This point, mentioned earlier in this section, was expressed unmistakably in a recent study[8] completed for the Division of Highways. The report noted, "All physical plant is subject to the effects of weather and natural catastrophic occurrences, sabotage, and vandalism. The means of minimizing these effects is to limit the number of plant sites... The use of microwave radio systems minimizes the number of plant sites. These can be protected to a greater degree econonically."

System Layout

Figure 4-6 shows the basic layout for a State-owned administrative voice and data network. Since video bandwidths are not involved, the system can be planned for licensing in the 6-GHz band to take advantage of the better propogation characteristics at that frequency. The biggest advantage is that a typical hop between microwave repeaters can be stretched to 40 miles from the 20 miles at 12-GHz since path attenuation--particularly from rain--is much less at the lower frequency.


PECATONICA
P
ROCKFORD
MH, N
ELGIN
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DES PLAINES
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WHEATON
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CHICAGO
H, MH, N
DEKALB
N
AURORA
N
HINSDALE
P, N
DIXON
H, MH
STERLING
N, P
ERIE
ROCK ISLAND
N, P
E. MOLINE
MH
MILAN
CD
BLUE ISLAND
P
TINLEY PARK
MH
JOLIET
N, P
OTTAWA
H
PERU
P
MANTENO
MH
KANKAKEE
P, MH, N
DWIGHT
MH
GALESBURG
MH, N
MONICA
METAMORA
P
PONTIAC
P, N
PEORIA
H, MH, N
EL PASO
PEKIN
CD
BUCKLEY
BLOOMINGTON
N
MACOMB
P
STILLWELL
LINCOLN
MH, N
DANVILLE
N
QUINCY
N, CD
CHAMPAIGN
MH, CD, N
PESOTUM
P
DECATUR
MH, N
JACKSONVILLE
MH, N
SPRINGFIELD
P, H, MH, N, CD
PARIS
H
PITTSFIELD
P
CHARLESTON
PANA
CARROLLTON
LITCHFIELD
P, N
EFFINGHAM
N, H
WATSON
P
ALTON
MH, N
EDWARDSVILLE
N
OLNEY
LAWRENCEVILLE
CD
COLLINSVILLE
P, MH, N
E. ST. LOUIS
H, N
CENTRALIA
MH
SWANSEA
CD
ALBION
P
MARISSA
THACKERAY
MENARD
MH
DU QUOIN
P, N
WEST FRANKFORT
CD
CARBONDALE
H, N
HARRISBURG
MH
ANNA
MH
CAIRO
P
LEGEND
■ MULTIPLEX TERMINAL STATION
◉ REPEATER STATION
P POLICE
H HIGHWAYS
MH MENTAL HEALTH
CD CIVIL DEFENSE MUTUAL AID CENTER
N NORMAL TRAFFIC
LEASED LINE
* DESCRIPTION OF TYPE OF TRAFFIC ORIGINATING OR TERMINATING AT THIS POINT

Figure 4-6

Administrative Network--State-Owned

The system components have been chosen and costed for a theoretical capacity of 600 channels but the costs for each leg are only for equipping it to handle the 1975 requirements. There are 35 stations equipped with mulitplex equipment to originate or terminate channels and another 11 stations that are simply repeaters.

Spur Lines

The cities listed in Table 4-15 and connected to the microwave system by broken lines in Figure 4-6 are not on the main microwave loops, but nevertheless present an operational requirement for full time access to the system. Because microwave towers in the low-volume corridors would be an unjustifiable expense--at least for years to come--these locations are grafted to the main system via leased land lines.

In costing these spur interconnections the logic has been to specify either Telpak A or B circuits, or private lines, whichever is cheaper. For a 12-voice channel, the Telpak A rate is $15 per mile, plus a $15 termination charge at each end of the line. Telpak B charges $20 per mile for a 24-voice channel, with identical termination charges. An individual, or private line, costs $3.50 a mile, with $4,50 termination charges at each end. Table 4-15 gives $105,924 per year for P-1 service and $93,756 for P-10 service as total charges for interconnecting spur cities to the microwave system.

Microwave Costs

The major cost in a voice and data line microwave network is for multiplex equipment. The requirements for multiplex terminations were determined as follows:

1. Voice line requirements (Table 4-3) and dedicated data line requirements (Table 4-5) were added together for total line requirements--Table 4-16.

Table 4-15

Cost of Leased Lines from Distant Cities, Administrative Network--State-Owned

	AGENCY	AIRLINE MILES	P-1 LINES	P-10 LINES	TELPAK MILEAGE COST/MO	TELPAK TERMINATION COST PER MO.		TOTAL TELPAK		P-1			P-10		
						P-1	P-10	P-1	P-10	MILEAGE COST @ $3.50	LINE TERM. COST @ $9.00	TOTAL LINE COST	MILEAGE COST @ $3.50	LINE TERM. COST @ $9.00	TOTAL LINE COST
BLUE ISLAND-CHICAGO	POLICE	15	6	5	$ 225	$ 180	$ 150	$ 405	$ 375						
CAIRO-CARBONDALE	"	50	7	6	750	210	180	960	930						
HINSDALE-CHICAGO	"	18	11	8	270	330	240	600	510						
METAMORA-PEORIA	"	12	6	4	180	180	120	360	300						
PECATONICA-ROCKFORD	"	12	4	4						$ 186.00	$ 36.00	$ 204.00	$ 168.00	$ 36.00	$ 204.00
PERU-OTTAWA	"	15	5	4						262.50	45.00	307.50	210.00	36.00	246.00
WATSON-EFFINGHAM	"	4	4	3						56.00	36.00	92.00	42.00	27.00	69.00
HARRISBURG-WEST FRANKFORT	MENTAL HEALTH	25	8	7	375	240	210	615	585						
LAWRENCEVILLE-ALBION	CIVIL DEFENSE	34	1	1						119.00	9.00	128.00	119.00	9.00	128.00
MILAN-ROCK ISLAND	"	6	1	1						21.00	9.00	30.00	21.00	9.00	30.00
PEKIN-PEORIA	"	12	1	1						42.00	9.00	51.00	42.00	9.00	51.00
SWANSEA-EAST ST. LOUIS	"	9	1	1						31.50	9.00	40.50	31.50	9.00	40.50
WHEATON-ELGIN	"	14	1	1						42.50	9.00	61.50	52.50	9.00	61.50
ANNA-CARBONDALE	MENTAL HEALTH	18	12	8	270	360	240	630	510						
CENTRALIA-DU QUOIN	"	40	9	7	600	270	210	870	810						
COLLINSVILLE-EAST ST. LOUIS	"	9	23	17	460	690	510	1,150	970						
DWIGHT-PONTIAC	"	18	3	2						189.00	27.00	216.00	126.00	18.00	144.00
E. MOLINE-ROCK ISLAND	"	7	3	2						73.50	27.00	100.50	49.00	18.00	67.00
MANTENO-KANKAKEE	"	12	9	6	180	270	180	450	360						
MENARD-DU QUOIN	"	36	6	4	540	180	120	720	660						
TINLEY PARK-CHICAGO	"	10	4	3						140.00	36.00	176.00	105.00	27.00	132.00
DANVILLE-CHAMPAIGN	NORMAL	32	6	5	480	180	150	660	630						
TOTAL			131	100				$ 7,420	$ 6,640			$ 1,407.00			$ 1,173.00
LINE COSTS (From Last Column)								1,407	1,173						
TOTAL LEASED LINE COST PER MONTH								$ 8,827	$ 7,813						
ANNUAL LEASED LINE COST-DISTANT CITY (Cost per month X 12)								$105,924	$ 93.756						

Table 4-16

1975 Summary of Voice and Data Line Requirements--
Springfield Traffic Corridors

	VOICE AND DATA LINES	
	P-1	P-10
SPRINGFIELD TO:		
Albion	5	5
Alton	19	14
Anna	12	8
Aurora	7	6
Bloomington	16	13
Blue Island	5	4
Cairo	6	5
Carbondale	28	21
Centralia	9	7
Champaign	35	30
Chicago	245	228
Collinsville	22	16
Decatur	24	18
Des Plaines	7	4
Dixon	15	13
DuQuoin	10	7
East St. Louis	19	16
Edwardsville	9	8
Effingham	13	10
Elgin	29	23
Galesburg	11	8
Germantown	5	3
Harrisburg	8	7
Hinsdale	10	7
Jacksonville	18	13
Joliet	20	16
Kankakee	13	11
Lincoln	18	13
Litchfield	9	6
Macomb	13	8
Menard	6	4
Ottawa	18	14
Paris	11	9
Pecatonica	3	3
Peoria	38	31
Peru	4	3
Pesotum	6	4
Pittsfield	6	5
Pontiac	11	9
Quincy	11	9
Rock Island	16	13
Rockford	14	12
Sterling	9	7
Watson	3	2
TOTAL	816	673

2. Hub cities with more than one traffic corridor were totaled by terminating city--Table 4-17.

3. All data above were compiled into multiplex termination requirements by adding spur volume on leased lines in Table 4-18.

Termination requirements, in multiples of 12 channels, were then computed along with the other factors previously mentioned as cost items. Table 4-19 presents microwave costs for multiplex terminal locations. Repeater station costs are outlined in Table 4-20.

Civil Defense Requirements

The microwave system layout includes five Civil Defense Mutual Aid Centers that are connected to the network by means of leased line spurs. These centers are located in Lawrenceville, Milan, Perkin, Swansea, and Wheaton (see Figure 4-6).

There are two additional possibilities if Civil Defense communications require complete freedom from common carrier facilities:

1. Add a microwave spur with a single terminal as follows (see Figure 4-6):

   Albion to Lawrenceville

   Rock Island to Milan

   Peoria to Pekin

   East St. Louis to Swansea

   Elgin to Wheaton

Table 4-17

Voice and Data Termination Requirements for Hub Cities with More Than One Traffic Corridor

HUB AND CONNECTING CITIES	VOICE & DATA LINES	
	P-1	P-10
ALTON TO:		
Edwardsville	19	15
Springfield	19	14
Total	38	29
AURORA TO:		
Chicago	5	3
Springfield	7	6
Total	12	9
BLOOMINGTON TO:		
Chicago	4	3
Springfield	16	13
Total	20	16
CARBONDALE TO:		
Champaign	4	3
Chicago	4	2
Edwardsville	23	19
Springfield	28	21
Total	59	45
CHAMPAIGN TO:		
Bloomington	6	4
Carbondale	4	3
Chicago	49	43
Danville	6	5
Decatur	7	5
Springfield	35	30
Total	107	90
CHICAGO TO:		
All Cities	150	119
Springfield	245	228
Total	395	347
DECATUR TO:		
Champaign	7	5
Chicago	3	2
Springfield	24	18
Total	34	25
DIXON TO:		
Chicago	7	5
Springfield	15	13
Total	22	18
E. ST. LOUIS TO:		
Chicago	3	2
Edwardsville	41	35
Springfield	19	16
Total	63	53
EDWARDSVILLE TO:		
Alton	19	15
Carbondale	23	19
Chicago	3	2
E. St. Louis	41	35
Springfield	9	8
Total	95	79
ELGIN TO:		
Chicago	16	13
Springfield	29	23
Total	45	36
JOLIET TO:		
Chicago	6	5
Springfield	20	16
Total	26	21
KANKAKEE TO:		
Chicago	9	6
Springfield	13	11
Total	22	17
MACOMB TO:		
Chicago	3	2
Springfield	13	8
Total	16	10
PEORIA TO:		
Chicago	4	3
Springfield	38	31
Total	42	34
ROCKFORD TO:		
Chicago	8	6
Springfield	14	12
Total	22	18
SPRINGFIELD TO:		
All Cities	816	673

Table 4-18

Multiplex Termination Requirements--Spur Locations Added

(P-1 and P-10 Grade)

	P-1 GRADE					P-10 GRADE				
	VOICE & DATA LINES	RADIO CONTROL LINES	CIVIL DEFENSE	TERM.	TOTAL	VOICE & DATA LINES	RADIO CONTROL LINES	CIVIL DEFENSE	TERM.	TOTAL
ALBION	5	1	-	6	7	5	1	-	6	7
LAWRENCEVILLE	-	-	1	1		-	-	1	1	
ALTON	38	-	-		38	29	-	-		29
AURORA	12	-	-		12	9				9
BLOOMINGTON	20	-	-		20	16	-	-		16
CARBONDALE	59	1	-	60	79	45	1	-	46	60
ANNA	12	-	-	12		8	-	-	8	
CAIRO	6	1	-	7		5	1	-	6	
CHAMPAIGN	107	-	1	108	114	90	-	1	91	96
DANVILLE	6	-	-	6		5	-	-	5	
CHICAGO	395	1	-	396	417	347	1	-	348	364
BLUE ISLAND	5	1	-	6		4	1	-	5	
HINSDALE	10	1	-	11		7	1	-	8	
TINLEY PARK	4	-	-	4		3	-	-	3	
DECATUR	34	-	-		34	25	-	-		25
DES PLAINES	7	1	-		8	4	1	-		5
DE KALB	11	-	-		11	9	-	-		9
DIXON	22	1	1		24	18	1	1		20
DU QUOIN	10	1	-	11	26	7	1	-	8	19
CENTRALIA	9	-	-	9		7	-	-	7	
HERRIN	6	-	-	6		4	-	-	4	
EAST ST. LOUIS	63	1	-	64	88	53	1	-	54	72
COLLINSVILLE	22	1	-	23		16	1	-	17	
SWANSEA	-	-	1	1		-	-	1	1	
EDWARDSVILLE	95	-	-		95	79	-	-		79
EFFINGHAM	13	1	-	14	18	10	1	-	11	14
MATTOON	3	1	-	4		2	1	-	3	
ELGIN	45	2	-	47	48	36	2	-	38	39
WHEATON	-	-	1	1		-	-	1	1	
GALESBURG	11	-	-		11	8	-	-		8
JACKSONVILLE	18	-	-		18	13	-	-		13

Table 4-18
(Continued)

	P-1 GRADE					P-10 GRADE				
	VOICE & DATA LINES	RADIO CONTROL LINES	CIVIL DEFENSE	TERM.	TOTAL	VOICE & DATA LINES	RADIO CONTROL LINES	CIVIL DEFENSE	TERM.	TOTAL
JOLIET	26	2	-		26	21	2	-		23
KANKAKEE	22	1	-	23	32	17	1		18	24
MANTENO	9	-	-	9		6	-	-	6	
LINCOLN	18	-	-		18	13	-	-		13
LITCHFIELD	9	1	-		10	6	1	-		7
MACOMB	16	1	-		17	10	1	-		11
OTTAWA	22	1	-	23	24	17	1	-	18	22
PERU	4	1	-	5		3	1	-	4	
PARIS	11	1	-		12	9	1	-		10
PEORIA	42	1	-	43	50	34	1	-	35	40
METAMORA	5	-	1	6		3	-	1	4	
PEKIN	-	-	1	1		-	-	1	1	
PESOTUM	6	1	-		7	4	1	-		5
PITTSFIELD	6	1	-		7	5	1	-		6
PONTIAC	11	1	-	12	15	9	1	-	10	12
DWIGHT	3	-	-	3		2	-	-	2	
QUINCY	11	1	1		12	10	-	-		10
ROCK ISLAND	16	1	-	17	21	13	1	-	14	17
EAST MOLINE	3	-	-	3		2	-	-	2	
MILAN	-	-	1	1		—	-	1	1	
ROCKFORD	22	-	-	22	26	15	-	-	15	19
PECATONICA	3	1	-	4		3	1	-	4	
SPRINGFIELD	816	31	9		856	673	31	9		713
STERLING	9	1	-		10	7	1	-		8
WEST FRANKFORT	-	-	1	1	9	-	-	1	1	8
HARRISBURG	8	-	-	8		7	-	-	7	
TOTAL					2222					1832

Table 4-19

Administrative Network--State-Owned Microwave

Costs for Multiplex Terminal Locations

				P-1							P-10						
LOCATION	LAND, TOWER, BLDG.	ANTENNAS @ $2,000	REPEATER EQUIP.	CHANNEL RQMT.	MUX. UNIT CAPACITY	MUX. COST	VOICE CHANNEL COST @ $92.00	EQUIP. COST	INSTALL COST (20% OF EQUIP.)	TOTAL P-1 COST	CHANNEL RQMT.	MUX. UNIT CAPACITY	MUX. COST	VOICE CHANNEL COST @ $92.00	EQUIP. COST	INSTALL COST (20% OF EQUIP.)	TOTAL P-10 COST
Albion	23,500	4,000	15,200	7	12	21,936	644	41,780	8,356	73,636	7	12	21,936	644	41,870	8,356	73,726
Alton	23,500	4,000	15,200	38	48	46,512	3,496	69,208	13,841	106,549	29	36	38,484	2,668	60,352	12,070	95,922
Aurora	23,500	6,000	22,950	12	12	21,936	1,104	51,990	10,398	85,888	9	12	21,936	828	51,714	10,343	85,557
Bloomington	23,500	4,000	15,200	20	24	30,096	1,840	51,136	10,227	84,863	16	24	30,096	1,472	50,768	10,154	84,422
Carbondale	23,500	4,000	15,200	79	84	72,996	7,268	99,464	19,893	142,857	60	60	54,660	5,520	79,380	15,876	118,756
Champaign	23,500	4,000	15,200	114	120	96,660	10,488	126,348	25,270	175,118	96	96	81,120	8,832	109,152	21,830	154,482
Chicago	23,500	4,000	15,200	417	420	318,360	38,364	375,924	75,185	474,609	364	372	286,812	33,488	339,500	67,900	430,900
Decatur	23,500	4,000	15,200	34	36	38,484	3,128	60,812	12,162	96,474	25	36	38,484	2,300	59,984	11,997	95,481
Des Plaines	23,500	4,000	15,200	8	12	21,936	736	41,872	8,374	73,746	5	12	21,936	460	41,596	8,319	73,415
De Kalb	23,500	4,000	15,200	11	12	21,936	1,012	42,148	8,430	74,078	9	12	21,936	828	41,964	8,393	73,857
Dixon	23,500	4,000	15,200	24	24	30,096	2,208	51,504	10,301	85,305	20	24	30,096	1,840	51,136	10,227	84,863
Du Quoin	23,500	4,000	15,200	26	36	38,484	2,392	60,076	12,015	95,591	19	24	30,096	1,748	51,044	10,208	84,752
E. St. Louis	23,500	4,000	15,200	88	96	81,120	8,096	108,416	21,683	153,599	72	72	65,160	6,624	90,984	18,197	132,681
Edwardsville	23,500	6,000	22,950	95	96	81,120	8,740	118,810	23,762	166,072	79	84	72,996	7,268	109,214	21,843	154,557
Effingham	23,500	6,000	22,950	18	24	30,096	1,656	60,702	12,140	96,342	14	24	30,096	1,288	60,334	12,066	95,900
Elgin	23,500	6,000	22,950	48	48	46,512	4,416	79,878	15,976	119,354	39	48	46,512	3,588	79,050	15,810	118,460
Galesburg	23,500	6,000	22,950	11	12	21,936	1,012	51,898	10,380	85,778	8	12	21,936	736	51,622	10,324	85,446
Jacksonville	23,500	4,000	15,200	18	24	30,096	1,656	50,952	10,190	84,642	13	24	30,096	1,196	50,492	10,098	84,090
Joliet	23,500	6,000	22,950	28	36	38,484	2,576	70,010	14,002	107,512	23	24	30,096	2,116	61,162	12,232	96,894
Kankakee	23,500	4,000	15,200	32	36	38,484	2,944	60,628	12,126	96,254	24	24	30,096	2,208	51,504	10,300	85,304
Lincoln	23,500	4,000	15,200	18	24	30,096	1,656	50,952	10,190	84,642	13	24	30,096	1,196	50,492	10,098	84,090
Litchfield	23,500	4,000	15,200	10	12	21,936	920	42,056	8,411	73,967	7	12	21,936	644	41,780	8,356	73,636
Metamora	23,500	6,000	22,950	6	12	21,936	552	51,438	10,288	85,226	4	12	21,936	368	51,254	10,250	85,004
Ottawa	23,500	4,000	15,200	24	24	30,096	2,208	51,504	10,301	85,305	19	24	30,096	1,748	51,044	10,208	84,752
Paris	23,500	4,000	15,200	12	12	21,936	1,104	42,240	8,448	74,188	10	12	21,936	920	42,056	8,411	73,967
Peoria	23,500	6,000	22,950	50	60	54,660	4,600	88,210	17,642	129,352	40	48	46,512	3,680	79,142	15,828	118,470
Pesotum	23,500	4,000	15,200	7	12	21,936	644	41,780	8,356	73,636	5	12	21,936	460	41,596	8,319	73,415
Pittsfield	23,500	4,000	15,200	7	12	21,936	644	41,780	8,356	73,636	6	12	21,936	552	41,688	8,337	73,525
Pontiac	23,500	4,000	15,200	15	24	30,096	1,380	50,676	10,135	84,311	12	12	21,936	1,104	42,240	8,448	74,188
Quincy	23,500	4,000	15,200	12	12	21,936	1,104	42,240	8,448	74,188	10	12	21,936	920	42,056	8,411	73,967
Rock Island	23,500	4,000	15,200	21	24	30,096	1,932	44,228	8,846	76,574	17	24	30,096	1,564	43,860	8,772	76,132
Rockford	23,500	4,000	15,200	26	36	38,484	2,392	60,076	12,015	95,591	22	24	30,096	2,024	51,320	10,264	85,084
Springfield	23,500	8,000	30,400	856	864	604,800	78,752	721,952	144,390	889,842	713	720	504,000	65,596	607,996	121,599	753,095
Sterling	23,500	4,000	15,200	10	12	21,936	920	42,056	8,411	73,967	8	12	21,936	736	41,872	8,374	73,746
West Frankfort	23,500	4,000	15,200	9	12	21,936	828	41,964	8,393	73,857	8	12	21,936	736	41,872	8,374	73,746
TOTALS										4,525,855							4,091,266

*There will usually be spare channels available because multiple terminal equipment is procured in blocks of 12 channels per equipment.

Table 4-20

Administrative Network--State-Owned Microwave Repeater Station Locations and Costs*

REPEATER STATION LOCATIONS	REPEATER STATION COSTS	
Buckley	Land Tower & Building	$ 23,500
Carrollton	Antennas @ $2,000 ea.	4,000
Charleston	Repeater Equipment	15,200
El Paso	Installation (20% of Equipment)	3,840
Erie		
Marissa	TOTAL	46,540
Monica		
Olney	TOTAL ELEVEN STATIONS	$511,940
Pana		
Stillwell		
Thackeray		

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[*] See summary of total costs in Table 4-21, page 133.

2. Add a fully redundant, two-way station as follows (See Figure 4-6):

Albion to Lawrenceville to Olney (Albion-Olney link out)
Galesburg to Milan to Rock Island (Galesburg-Rock Island link out)
Bloomington to Perkin to Peoria (Bloomington-Peoria link out)
Marissa to Swansea to E. St. Louis (Marissa-E. St. Louis link out)
Aurora to Wheaton to Elgin (Aurora-Elgin link out)

The primary consideration in placing the five locations on leased lines was the annual cost analysis as follows:

Proposed Total Leased Lines	$ 3,732 per year
If Microwave Spurs	$56,272 per year
If Fully Redundant Microwave Stations	$84,796 per year

Local Distribution

The terminating multiplex channels are connected to switching equipment in the origination and destination cities by local leased lines. The charge for a local leased line is $4.50 a mile and $4.50 termination per month at one end. The connection charges at the other end (the microwave station) have not been included. (See Introduction--Carterfone Case)

The costs of connecting the voice and data lines into the local telephone system are $225,828 per year for P-1 service and $187,056 for P-10 service.

Table 4-21 summarizes all the separate costs of the system, including accessories and spares. The system is then amortized over a 15-year economic life including maintenance, interest and lost taxes. For P-1 service the annual cost to the State is $1,145,063. For P-10 service, the yearly cost is estimated to be $1,044,713. Spur leased lines and local terminations add another $331,752 for P-1 service and $280,812 for P-10 service. The realistic annual cost of the State-owned administrative system totals at $1,476,815 for P-1 service and $1,325,525 for P-10 service.

Table 4-21

Administrative Network Cost Summary--
State-Owned Microwave System

	P-1	P-10
35 Multiplex Terminal Stations	$4,525,855	$4,091,266
11 Repeater Stations	511,940	511,940
	5,037,795	4,603,206
15% Accessories and Spares Chicago, Springfield, Carbondale	226,096	195,412
5% Accessories and Spares Balance of Stations	176,524	165,022
GRAND TOTAL	5,440,415	4,963,640
INTEREST 5%		
Cost of Money - 5% for 15 Years Amortized to Pay Off in 15 Years	2,421,535	2,209,315
MAINTENANCE		
10% per Year for 15 Years	8,160,630	7,445,460
LOST TAXES		
2.5% per Year for 15 Years	1,153,367	1,052,292
TOTAL 15 YEAR LIFE	17,175,947	15,670,707
ANNUAL COST	1,145,063	1,044,713
Leased Line Cost - Distant Cities		
Annual Cost	105,924	93,756
Leased Line Cost - Local Terminations		
Annual Cost	225,828	187,056
TOTAL ANNUAL COST	$1,476,815	$1,325,525

Combined ETV And Administrative Network - State-Owned Microwave

As stated in the discussion of the State-owned ETV microwave network, there is no distinction as to type of traffic that may be sent over a 12-GHz microwave system. Thus it appears feasible to consider such a system for handling not only administrative but also ETV traffic.

To provide a microwave network capable of meeting the combined ETV and administrative traffic requirements of the State, the basic ETV network has been modified to include terminal locations specified in the highway microwave system study, done by the Motorola Corporation.[8]

This study specified site requirements for the State Police, the Division of Highways, and the Civil Defense Agency. Some additional cities were included in the network because appreciable amounts of administrative traffic originated at those points. This resulted in four additional relay stations that are not required for the ETV network by itself. The changes are:

- One extra repeater between De Kalb and Freeport was required to pick up the administrative traffic at Pecatonica and Rockford.
- One extra repeater between Charleston and Olney was required to pick up the normal traffic and the priority State Police and Highway circuits at Effingham.

- Two additional repeaters were added between Elgin and Joliet to provide the circuit redundancy required by the State Police in the Chicago area.

One less repeater was required by routing directly from Carlinville to Springfield, leaving out Nokomis which seemed to have no function other than that of a repeater. Figure 4-7 displays a network that combines the ETV and the administrative functions.

This method of locating repeaters makes it relatively inexpensive to add additional equipment to the towers, antennas, reflectors, power supplies, and other common equipment for the purpose of providing voice channel inputs at these various cities. The cost of providing the additional terminal equipment, multiplexing equipment, and other facilities needed to provide an administrative network have been costed separately from the basic educational TV system.

The configuration interconnects all State Police, Highways, Civil Defense, and Mental Health facilities with some form of dedicated services. In addition to these priority subsystems, the network picks up those cities that either generate or terminate major traffic volumes (see the Requirements section for a discussion of major intercity corridors).

Reliability is assured first by path redundancy and second by channel redundancy on each path. All groups of circuits are divided in two and follow separate paths through the network to their destinations. If either path is broken by a failure the remaining one will provide service at a reduced grade of service. Channel redundancy is provided by installing a spare voice channel for every one assigned. If an individual voice channel fails the equipment automatically switches over to its spare and sends an alarm to a maintenance station.

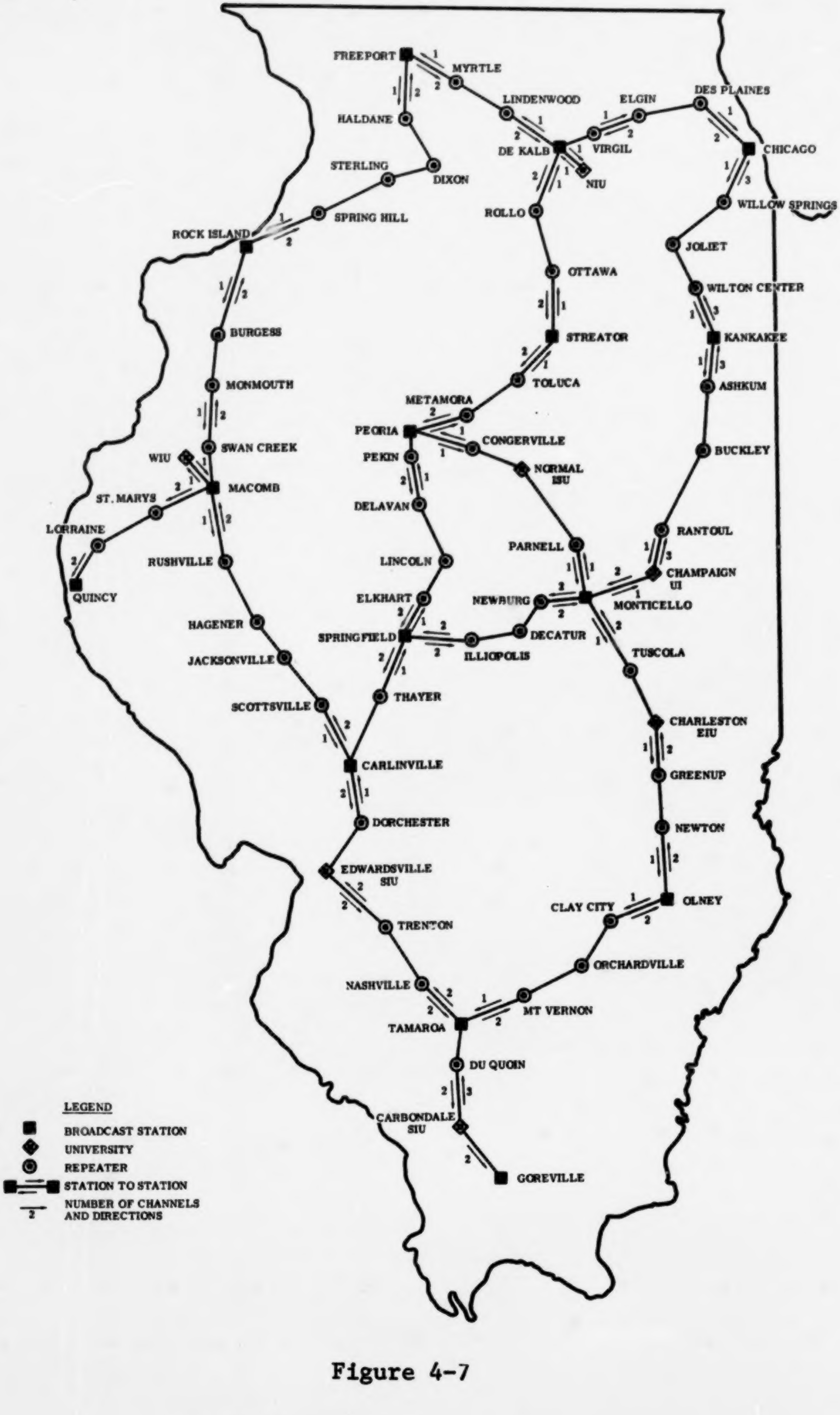
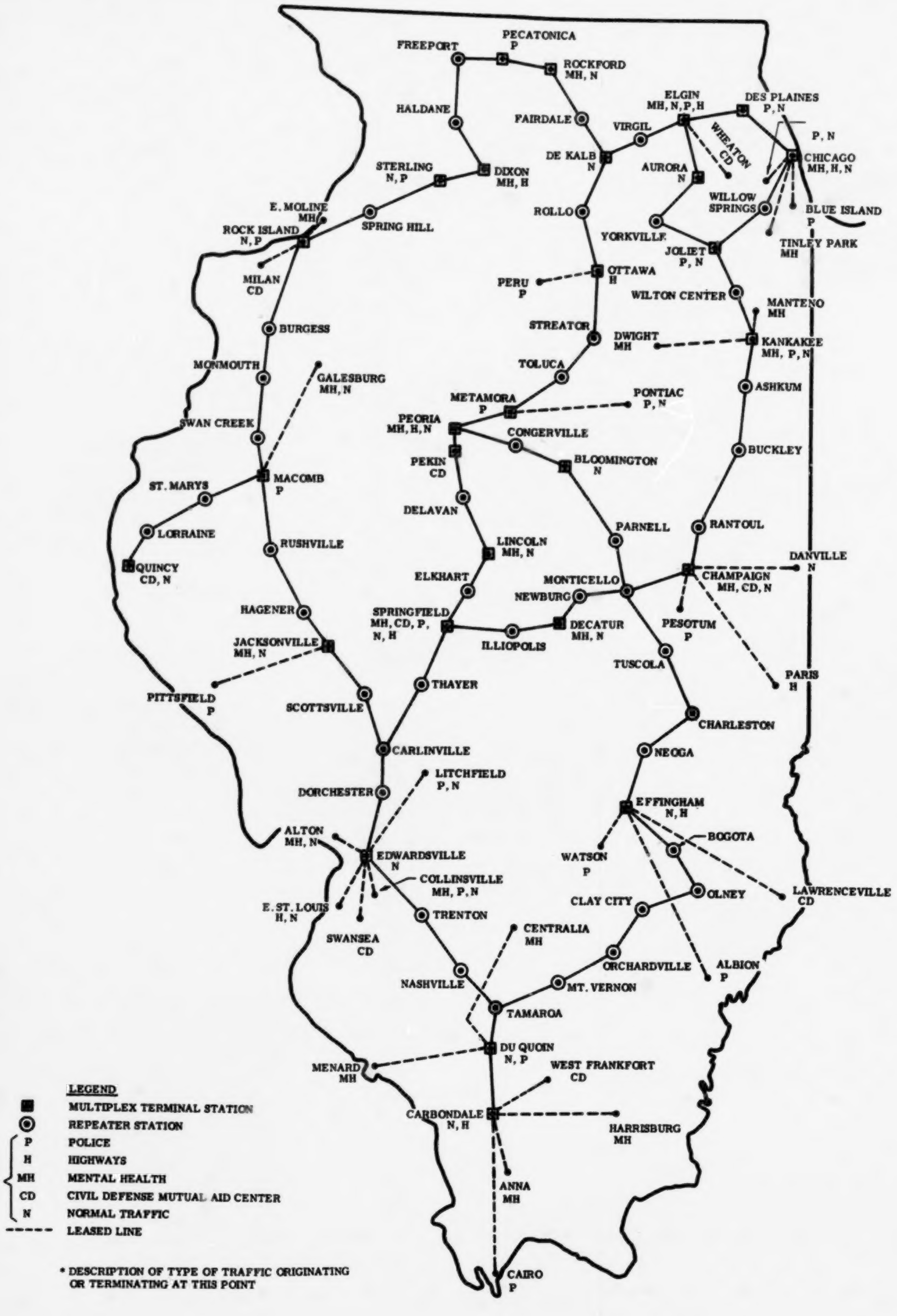

FREEPORT
MYRTLE
HALDANE
LINDENWOOD
ELGIN
DES PLAINES
DE KALB
VIRGIL
CHICAGO
NIU
STERLING
DIXON
ROLLO
WILLOW SPRINGS
SPRING HILL
ROCK ISLAND
JOLIET
OTTAWA
WILTON CENTER
BURGESS
STREATOR
KANKAKEE
TOLUCA
MONMOUTH
ASHKUM
METAMORA
PEORIA
CONGERVILLE
SWAN CREEK
WIU
PEKIN
NORMAL ISU
BUCKLEY
MACOMB
ST. MARYS
DELAVAN
LORRAINE
RANTOUL
PARNELL
RUSHVILLE
LINCOLN
CHAMPAIGN UI
QUINCY
ELKHART
NEWBURG
MONTICELLO
HAGENER
SPRINGFIELD
DECATUR
ILLIOPOLIS
TUSCOLA
JACKSONVILLE
SCOTTSVILLE
THAYER
CHARLESTON EIU
CARLINVILLE
GREENUP
DORCHESTER
NEWTON
EDWARDSVILLE SIU
OLNEY
CLAY CITY
TRENTON
ORCHARDVILLE
NASHVILLE
MT VERNON
TAMAROA
DU QUOIN
CARBONDALE SIU
GOREVILLE
LEGEND
BROADCAST STATION
UNIVERSITY
REPEATER
STATION TO STATION
NUMBER OF CHANNELS AND DIRECTIONS

Figure 4-7

Network Combining State ETV Traffic
and Administrative Capabilities


FREEPORT
PECATONICA P
ROCKFORD MH, N
HALDANE
FAIRDALE
ELGIN MH, N, P, H
DES PLAINES P, N
P, N
VIRGIL
WHEATON CD
DE KALB N
CHICAGO MH, H, N
STERLING N, P
DIXON MH, H
AURORA N
WILLOW SPRINGS
BLUE ISLAND P
E. MOLINE MH
ROCK ISLAND N, P
SPRING HILL
ROLLO
YORKVILLE
TINLEY PARK MH
JOLIET P, N
MILAN CD
PERU P
OTTAWA H
WILTON CENTER
MANTENO MH
BURGESS
STREATOR
DWIGHT MH
KANKAKEE MH, P, N
MONMOUTH
GALESBURG MH, N
TOLUCA
ASHKUM
METAMORA P
PONTIAC P, N
SWAN CREEK
PEORIA MH, H, N
CONGERVILLE
BUCKLEY
PEKIN CD
BLOOMINGTON N
MACOMB P
ST. MARYS
LORRAINE
DELAVAN
RANTOUL
RUSHVILLE
LINCOLN MH, N
PARNELL
QUINCY CD, N
DANVILLE N
ELKHART
MONTICELLO
CHAMPAIGN MH, CD, N
NEWBURG
HAGENER
SPRINGFIELD MH, CD, P, N, H
DECATUR MH, N
PESOTUM P
JACKSONVILLE MH, N
ILLIOPOLIS
TUSCOLA
PARIS H
THAYER
PITTSFIELD P
SCOTTSVILLE
CHARLESTON
CARLINVILLE
NEOGA
LITCHFIELD P, N
DORCHESTER
EFFINGHAM N, H
ALTON MH, N
BOGOTA
EDWARDSVILLE N
WATSON P
COLLINSVILLE MH, P, N
OLNEY
LAWRENCEVILLE CD
E. ST. LOUIS H, N
TRENTON
CLAY CITY
CENTRALIA MH
SWANSEA CD
ORCHARDVILLE
ALBION P
NASHVILLE
MT. VERNON
TAMAROA
DU QUOIN N, P
MENARD MH
WEST FRANKFORT CD
CARBONDALE N, H
HARRISBURG MH
ANNA MH
CAIRO P
LEGEND
■ MULTIPLEX TERMINAL STATION
◎ REPEATER STATION
P POLICE
H HIGHWAYS
MH MENTAL HEALTH
CD CIVIL DEFENSE MUTUAL AID CENTER
N NORMAL TRAFFIC
---- LEASED LINE
* DESCRIPTION OF TYPE OF TRAFFIC ORIGINATING OR TERMINATING AT THIS POINT

Costs

Several factors enter into the total cost picture for the State-owned combined microwave network. First, there are the basic microwave network costs. Second, there are additional costs arising from the need to interconnect spur cities via leased line to the basic microwave network. Finally, there are costs for leased lines to connect the microwave terminals to the local telephone system.

Microwave Costs

Table 4-22 summarizes total system costs for land, buildings (including heating, air conditioning, emergency power, towers), antennas, multiplexers, voice channels, installation, and related factors. These costs, calculated for P-1 and P-10 service, are based on the unit prices listed in the introductory portion of this section. Channel requirements are derived from Table 4-3, which projected 1975 voice line requirements. Multiplex (voice or data) channel units are sold in increments of 12, and cost an additional $92 per channel for voice connections for each channel actually used.

Civil Defense Spur Costs

The microwave system layout includes five Civil Defense Mutual Aid Centers that are connected to the network by means of leased line spurs. These centers are located in Lawrenceville, Milan, Swansea, West Frankfort, and Wheaton.

There are two additional possibilities if Civil Defense communications require complete freedom from common carrier facilities:

Table 4-22

Costs of Combined State-Owned Microwave ETV and Administrative Network

					P-1						P-10					
LOCATION	LAND, TOWER, BLDG.	ANTENNAS @ $2,000	TOTAL (1 + 2)	REPEATER EQUIP.	CHANNEL RQMT.	CHANNEL CAPACITY	MUX. COST	EQUIP.COST TOTAL (4 + 5)	INSTALL CHARGE (20% of 6)	TOTAL P-1 COST (3,6,7)	CHANNEL RQMT.	CHANNEL CAPACITY	MUX. COST	EQUIP.COST TOTAL (4 + 9)	INSTALL CHARGE (20% of 10)	TOTAL P-10 COST (3,10,11)
	(1)	(2)	(3)	(4)			(5)	(6)	(7)	(8)			(9)	(10)	(11)	(12)
Ashkum				$15,200				$15,200	$ 3,040	$ 18,240				$ 15,200	$ 3,040	$ 18,240
*Aurora	$23,500	$ 4,000	$27,500	15,200	17	24	$30,096	45,296	9,059	81,855	11	12	$21,936	37,136	7,427	72,063
*Bogota	23,500	4,000	27,500	15,200				15,200	3,040	45,740				15,200	3,040	45,740
Buckley				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Burgess				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Carbondale				15,200	86	96	81,120	96,320	19,264	115,584	66	72	65,160	80,360	16,072	96,432
Carlinville				22,950				22,950	4,590	27,540				22,950	4,590	27,540
Champaign				15,200	107	108	88,668	103,868	20,774	124,642	91	96	81,120	96,320	19,264	115,584
Charleston				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Chicago				15,200	414	420	310,896	326,096	65,219	391,315	361	372	273,240	288,440	57,688	346,128
Clay City				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Congerville				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Decatur				15,200	34	36	38,484	53,684	10,736	64,420	25	36	38,484	53,684	10,736	64,420
De Kalb				22,950	11	12	21,936	44,886	8,977	53,863	[illegible]	12	21,936	44,886	8,977	53,863
Delavan				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Des Plaines				15,200	7	12	21,936	37,136	7,427	44,563	4	12	21,936	37,136	7,427	44,563
Dixon				15,200	22	24	30,096	45,296	9,059	54,355	18	24	30,096	45,296	9,059	54,355
Dorchester				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Du Quoin				15,200	25	36	38,484	53,684	10,736	64,420	18	24	30,096	45,296	9,059	54,355
Edwardsville				15,200	227	228	185,520	200,720	40,144	240,864	183	192	153,984	169,184	33,837	203,021
*Effingham	23,500	4,000	27,500	15,200	22	24	38,484	53,684	10,736	91,920	18	24	30,096	45,296	9,059	81,855
Elgin		2,000	2,000	22,950	45	48	46,512	69,462	13,892	85,354	36	36	38,484	61,434	12,286	75,720
Elkhart				15,200				15,200	3,040	18,240				15,200	3,040	18,240
*Fairdale	23,500	4,000	27,500	15,200				15,200	3,040	45,740				15,200	3,040	45,740
Freeport				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Goreville				7,750				7,750	1,550	9,300				7,750	1,550	9,300
Hagener				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Haldane				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Illiopolis				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Jacksonville				15,200	24	24	30,096	45,296	9,059	54,355	18	24	30,096	45,296	9,059	54,355
Joliet		2,000	2,000	22,950	26	36	38,484	61,434	12,286	75,720	21	24	30,096	53,046	10,609	65,655
Kankakee				15,200	31	36	38,484	53,684	10,736	64,420	23	24	30,096	45,296	9,059	54,355
Lincoln				15,200	18	24	30,096	45,296	9,059	54,355	13	24	30,096	45,296	9,059	54,355
Lorraine				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Macomb				22,950	38	48	38,484	61,434	12,287	73,721	27	36	30,096	53,046	9,059	54,355
Metamora				15,200	33	36	38,484	53,684	10,736	64,420	25	36	38,484	53,684	10,736	64,420
Monticello				30,400				30,400	6,080	36,480				30,400	6,080	36,480
Monmouth				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Mt. Vernon				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Nashville				15,200				15,200	3,040	18,240				15,200	3,040	18,240

Table 4-22
(Continued)

					P-1						P-10					
LOCATION	LAND, TOWER, BLDG.	ANTENNAS @ $2,000	TOTAL (1 + 2)	REPEATER EQUIP.	CHANNEL RQMT.	CHANNEL CAPACITY	MUX. COST	EQUIP.COST TOTAL (4 + 5)	INSTALL CHARGE (20% of 6)	TOTAL P-1 COST (3,6,7)	CHANNEL CHANNEL RQMT.	CHANNEL CHANNEL CAPACITY	MUX. COST	EQUIP.COST TOTAL (4 + 9)	INSTALL CHARGE (20% of 10)	TOTAL P-10 COST (3,10,11)
	(1)	(2)	(3)	(4)			(5)	(6)	(7)	(8)			(9)	(10)	(11)	(12)
*Neoga	$23,500	$ 4,000	$27,500	$ 15,200				$15,200	$ 3,040	$ 45,740				$15,200	$ 3,040	$ 45,740
Newburg				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Normal				15,200	26	36	$ 38,484	53,684	10,736	64,420	20	24	$30,096	45,296	9,059	54,355
Olney				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Orchardville				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Ottawa				15,200	22	24	30,096	45,296	9,059	54,355	17	24	30,096	45,296	9,059	54,355
Parnell				15,200				15,200	3,040	18,240				15,200	3,040	18,240
*Pecatonica	23,500	4,000	27,500	15,200	3	12	21,936	37,136	7,427	72,063	3	12	21,936	37,136	7,427	72,063
Pekin				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Peoria				22,950	42	48	46,512	69,462	13,892	83,354	34	36	46,512	69,462	13,892	83,354
Quincy				7,750	11	12	21,936	29,686	5,937	35,623	9	12	21,936	29,686	5,937	35,623
Rantoul				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Rock Island				15,200	20	24	30,096	45,296	9,059	54,355	16	24	30,096	45,296	9,059	54,355
*Rockford	23,500	4,000	27,500	15,200	22	24	30,096	45,296	9,059	81,855	18	24	30,096	45,296	9,059	81,855
Rollo				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Rushville				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Scottsville				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Spring Hill				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Springfield				22,950	816	828	612,000	634,950	126,990	761,940	673	684	504,750	527,700	105,540	633,240
St. Mary's				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Sterling				15,200	9	12	21,936	37,136	7,427	44,563	7	12	21,936	37,136	7,427	44,563
Streator				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Swan Creek				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Tamaroa				22,950				22,950	4,590	27,540				22,950	4,590	27,540
Thayer				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Toluca				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Trenton				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Tuscola				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Willow Springs				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Wilton Center				15,200				15,200	3,040	18,240				15,200	3,040	18,240
Virgil				15,200				15,200	3,040	18,240				15,200	3,040	18,240
*Yorkville	23,500	4,000	27,500	15,200				15,200	3,040	45,740				15,200	3,040	45,740
TOTALS										$4,021,086						$3,664,731

1. Add a microwave spur with a single terminal as follows:

    Olney to Lawrenceville

    Rock Island to Milan

    Edwardsville to Swansea

    Carbondale to West Frankfort

    Aurora to Wheaton

2. Add a fully redundant two-way station as follows:

    Carbondale to West Frankfort to Macedonia to Barnhill to West Salem to Lawrenceville to Olney. Link out Mt. Vernon, Orchardville, and Clay City. Trenton to Swansea to Edwardsville, instead of linking Trenton to Edwardsville.

    Rushville to Timewell to Quincy, instead of linking Rushville to Macomb.

    Burgess to Milan to Rock Island, instead of linking Burgess to Rock Island.

    Elgin to Wheaton to Aurora, instead of linking Elgin to Aurora.

The primary consideration in placing the five locations on leased lines was the annual cost analysis as follows:

Proposed Total leased lines	P-1:	$ 5,280 per year
	P-10:	$ 4,488 per year
If Microwave Spurs		$56,651 per year
If Fully Redundant Microwave Stations		$75,879 per year

Spur Lines

The cities listed in Table 4-23 and connected to its microwave system by dotted lines in Figure 4-6 are connected by leased lines. The costing for the leased lines is the same as done for the State-owned administrative system. Table 4-23 gives $192,132 per year for P-1 service and $172,632 for P-10 service as total charges for connecting spur cities to the microwave system.

Local Distribution

A third set of charges stems from the necessity to connect the terminating multiplex channels to the switching equipment in the origination and destination city. This is accomplished by using leased common carrier lines from the microwave station into the nearest State government switcher, either a Centrex system or PBX. The rate charged by the common carrier for this local service is that charged for a private, or leased line--$4.50 a mile, plus $4.50 termination at one end. The connection charges at the microwave station have not been included. (See Introduction--Carterfone case)

In arriving at local termination costs for the entire system, it was assumed that there would always be some State-operated switcher within one mile of the microwave tower. Table 4-24 includes local termination costs for the voice and data portion of the combined system. These add $214,164 for P-1 service and $177,552 for P-10 service to the annual system costs.

Table 4-23

Combined ETV and Administrative Network Cost of Leased Lines from Distant Cities

	AGENCY	AIRLINE MILES	P-1 LINES	P-10 LINES	TELPAK MILEAGE COST/MO	TELPAK TERMINATION COST PER MO.		TOTAL TELPAK		P-1			P-10		
						P-1	P-10	P-1	P-10	MILEAGE COST @ $3.50	LINE TERM. COST @ $9.00	TOTAL LINE COST	MILEAGE COST @ $3.50	LINE TERM. COST @ $9.00	TOTAL LINE COST
ALBION-EFFINGHAM	POLICE	57	5	5						$ 997.50	$ 45.00	$1,042.50	$ 977.50	$ 45.00	$ 1,042.50
BLUE ISLAND-CHICAGO	"	15	5	4						262.50	45.00	307.50	210.00	36.00	246.00
CAIRO-CARBONDALE	"	50	6	5	$ 750	$ 180	$ 150	$ 930	$ 900						
HINSDALE-CHICAGO	"	18	10	7	270	300	210	570	480						
LITCHFIELD-EDWARDSVILLE	"	30	9	6	450	270	180	720	630						
PITTSFIELD-JACKSONVILLE	"	30	6	5	450	180	150	630	600						
PONTIAC-METAMORA	"	39	11	9	165	330	270	495	435						
WATSON-EFFINGHAM	"	4	3	2						42.00	27.00	69.00	28.00	18.00	46.00
E. ST. LOUIS-EDWARDSVILLE	HIGHWAY	15	53	53	899	1,890	1,590	2,790	2,490						
PARIS-CHAMPAIGN	"	46	11	9	690	330	270	1,020	960						
LAWRENCEVILLE-EFFINGHAM	CIVIL DEFENSE	52	1	1						182.00	9.00	191.00	182.00	9.00	191.00
MILAN-ROCK ISLAND	"	6	1	1						21.00	9.00	30.00	21.00	9.00	30.00
SWANSEA-EDWARDSVILLE	"	20	1	1						70.00	9.00	79.00	70.00	9.00	79.00
WEST FRANKFORT-CARBONDALE	"	20	1	1						70.00	9.00	79.00	70.00	9.00	79.00
WHEATON-CHICAGO	"	15	1	1						52.50	9.00	61.50	52.50	9.00	61.50
								7,150	6,495			1,859.50			1,775.00
ALTON-EDWARDSVILLE	MENTAL HEALTH	12	38	29	420	1,140	879	1,560	1,290						
ANNA-CARBONDALE	"	18	12	8	270	360	240	630	510						
CENTRALIA-DU QUOIN	"	40	9	7	600	270	210	870	810						
DWIGHT-KANKAKEE	"	28	3	2						294.00	27.00	321.00	196.00	18.00	214.00
E. MOLINE-ROCK ISLAND	"	7	3	2						73.50	27.00	100.50	49.00	18.00	67.00
GALESBURG-MACOMB	"	36	11	8	540	330	240	870	780						
HARRISBURG-CARBONDALE	"	39	8	7	585	240	210	820	795						
MANTENO-KANKAKEE	"	12	9	6	180	270	180	450	360						
MENARD-DU QUOIN	"	36	6	4	540	180	120	720	660						
DANVILLE-CHAMPAIGN	NORMAL	32	6	5	480	180	150	660	630						
TOTAL			239	188				$ 13,730	$ 12,330						
LINE COSTS (From Data Line Column)								2,281	2,056			$ 2,281.00			$ 2,056.00
TOTAL LEASED LINE COST PER MONTH								$ 16,011	$ 14,386						
ANNUAL LEASED LINE COST-DISTANT CITY (Cost per month X 12)								$ 192,132	$ 172,632						

Table 4-24

State-Owned ETV and Administrative Network, 12 GHz Microwave System Cost Summary

	P-1			P-10		
	ETV ALONE	ADD-ON ADMINISTRATIVE	TOTAL COMBINATION SYSTEM	ETV ALONE	ADD-ON ADMINISTRATIVE	TOTAL COMBINATION SYSTEM
EQUIPMENT AND INSTALLATION	$ 3,734,850	$ 4,021,086	$ 7,755,936	$ 3,734,850	$ 3,664,731	$ 7,399,581
15% ACCESSORIES AND SPARES CHICAGO, SPRINGFIELD, AND CARBONDALE	27,908	190,326	218,234	27,908	161,370	189,278
5% ACCESSORIES AND SPARES ALL OTHERS	177,440	137,126	314,566	177,440	130,790	308,230
TOTAL COST	3,940,198	4,348,538	8,288,736	3,940,198	3,956,891	7,897,089
INTEREST 5% - COST OF MONEY 15 YEARS	1,753,787	1,935,532	3,689,319	1,753,787	1,761,199	3,514,986
MAINTENANCE - 10% FOR 15 YEARS	5,910,300	6,522,810	12,433,110	5,910,300	5,935,335	11,845,635
LOST TAXES - 2.5% FOR 15 YEARS DEPRECIATED	835,321	921,890	1,757,211	835,325	838,860	1,674,181
TOTAL 15 YEAR COST	12,439,606	13,728,770	26,168,376	12,439,606	12,492,285	24,931,891
ANNUAL COST	829,307	915,251	1,744,558	829,307	832,819	1,662,126
LEASED LINE COST FOR SPURS TO DISTANT CITIES	---	192,132	192,132	---	172,632	172,632
LEASED LINE COST FOR LOCAL TERMINATIONS (4.50 MILEAGE + 4.50 TERM) P-1 TERM 1,983 P-10 TERM 1,644	---	214,164	214,164	---	177,552	177,552
TOTAL ANNUAL COST	$ 829,307	$ 1,321,547	$ 2,150,854	$ 829,307	$ 1,183,003	$ 2,012,310

Land Mobile Radio

Land mobile radio operations are presented separately. By their nature, they are State-owned facilities that will remain essentially the same, regardless of which alternative plan is adopted for the point-to-point telecommunications network. However, the requirements for point-to-point channels to supplement and interface with the mobile radio sub-systems were presented as part of the 1975 intercity telephone requirements section and the capability for this function is provided by the interconnection network designs.

There are several differences that set land mobile operations apart from most State telecommunications activities. To begin with, a major part of the State-owned mobile radio system is devoted to emergency services. Agencies like the State Police and the Division of Highways must be able to work with their large mobile fleets on a round-the-clock basis.

Second, the solution to present radio frequency congestion problems involves State government with other political jurisdictions, including the Federal Communications Commission (FCC). Because a shortage of land mobile broadcast frequencies is the most acute issue, the State must depend on the FCC for relief. The Commission, in turn, must weigh not only State needs, but also those of local governments, business, and private citizens.

The frequency problem traces to the tremendous growth of land mobile radio in recent years, a growth that in the words of the FCC, "has presented the nation with a most serious frequency congestion problem."* All useable allocated frequencies in the land mobile frequency spectrum are now assigned, and recent new allocations (the 450-470 MHz bands, for example) disappear with startling speed. Table 4-25 shows the history of mobile transmitter licensing since 1950 and the FCC estimates of future licensing through 1975.

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*Figures are exclusive of land mobile radio equipment used by the Federal government.

TABLE 4-25. PAST AND FUTURE MOBILE TRANSMITTER LICENSING TRENDS[9]

YEAR	TRANSMITTERS*
1950	180,000
1955	520,000
1960	1,300,000
1965	2,280,000
1970	3,500,000
1975	5,200,000

Generally speaking, the FCC notes that the land mobile frequencies are "very badly overcrowded in most major metropolitan areas." The Commission goes on to say that "communications are not only poor, slow and difficult, but in many cases impossible, because of this overcrowding."[9] Chicago is one of the regions in which congestion is most acute, while the St. Louis area is approaching saturation.

Urban Radio Problem

As mentioned earlier (in the Requirements section), all but two State agencies will have adequate frequency space to conduct their radio operations and respond to increased requirements projected for 1975. The exceptions to this case are the State's largest and most extensive radio users--the State Police and the Division of Highways. These agencies regard the urban congestion dilemma as the main obstacle in dealing effectively with their future radio requirements. Both agencies face immediate problems only in the Chicago area. In Madison-St. Clair Counties adjacent to St. Louis both agencies have access to enough frequency space to accommodate increased demand over the next seven years. The State Police plans construction of a new base station at

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*Figures are exclusive of land mobile radio equipment used by the Federal government.

Maryville (St. Clair County) in 1969, and that additional radio capability will satisfy requirements projected through 1975.

The Chicago area, however, presents an acute and difficult situation for State radio operations. In its 1967 Report of the Advisory Committee for the Land Mobile Radio Services, the FCC found that Chicago was one of the two or three most heavily saturated urban areas in terms of overloaded land mobile frequencies. One State agency official disclosed to SDC that his organization now considers Chicago a "closed area" to additional land mobile broadcasting.

This shortage of land mobile frequencies come at a time when future State radio requirements for the Chicago area are expected to be sizeable. In Greater Chicago alone, through 1975, this study has forecast a 17 percent increase for Highways. The coverage area includes Cook, Du Page, Kane, Lake, McHenry, and Will Counties. As the State-owned radio networks to meet increased demands in the Chicago area with only those broadcast frequencies now available to them. The FCC is convinced that "genuine relief, which is needed immediately, can only be achieved by the allocation of additional frequency spectrum to these (land mobile) services."[9]

Those charged with the management of state-owned radio systems in Chicago concur that this is an accurate assessment of the land mobile frequency situation. They realize keenly that their ability to meet future responsibilities will depend to a large extent on what the FCC does toward assigning additional frequency space for land mobile use. Many Illinois organizations took part in the FCC's 1967 study of the land mobile situation. Both the State Police and the Division of Highways contributed, as did several State businesses and industrial groups. This broad-based effort is evidence that the FCC regards land mobile frequency relief as an urgent and first priority task.

Chicago area police land mobile radio problems came in for close scrutiny in a July 1968 study completed by the Associated Public-Safety Communications Officers, Inc., (APCO) and the ITT Research Instute of Chicago.[10] The study concentrated on the Chicago Standard Metropolitan Statistical Area and urban Wisconsin and Indiana counties along Lake Michigan. In surveying police radio networks in this area, the investigators found spectrum space to be unevenly utilized, with extremely heavy congestion in some networks and relatively light traffic in others.

The study also addressed itself to ways that police might use available technical innovations to improve utilization of existing frequences. One such innovation, digital teleprinters in mobile units, was viewed as promising but still too experimental to be regarded as an adequate short-term solution. (See Post 1975 section for more extended discusssion of digital techniques.) The use of computers for command/control functions and car location were viewed in much the same terms (see Post 1975 section).

The researchers devoted considerable discussion to interservice channel sharing, an approach that has been widely debated as a method for improving frequency utilization. The idea here is that police might "take over" certain industrial frequencies when those frequencies are unused by industrial land mobile services. While acknowledging that such reassignment is technically feasible, the report noted that police network requirements of priority and security of messages must be satisfied before any frequency sharing approach becomes acceptable. This last point, the report noted, will require a "great deal of work by the services involved."

In view of their findings, the investigators concluded that "congestion on police channels is very serious and undoubtedly impairs the effectiveness of the law enforcement function of police departments in the Lake Michigan metropolitan area." (Includes State Police operations in the Chicago SMSA.) The report further made it clear that more spectrum space is required not just to meet future needs, but to satisfy existing demand on the present networks. Taking all this into consideration, and looking ahead into the next decade, APCO concluded that "the effective utilization of the existing spectrum allocation and additional spectrum allocations requires that there be formal cooperative network arrangements based upon the needs of the departments involved." This means interjurisdictional coordination in designing existing network patterns or planning coverage with new frequency assignments.

UHF Frequencies

The FCC's latest and most definitive statement on the frequency congestion issue is Docket No. 18261, released July 26, 1968. In effect, this Docket amends FCC regulations to make UHF-TV channels 14 through 20 (470-512 MHz) available to land mobile services in urban areas. This allocation is a solution long advocated by the Land Mobile Emergency Relief Committee and other interested organizations.

The Commission set December 2, 1968 as the deadline for filing concurring or dissenting opinions on the amendment. These will be weighed and examined according to established FCC procedures before the Commissioners issue a final pronouncement on this frequency reassignment. If the amendment carries, there will still remain such problems as geographical allocations and specific frequency assignments. The pressure is so intense, however, that these requirements should be ironed out speedily, perhaps as early as summer, 1969.

Tentatively, Chicago and Northwestern Indiana will share Channels, 16, 17, and 18, while St. Louis will receive Channels 14, 15, 16, and 20. Table 4-26 summarizes utilization of this spectrum space and is based on the FCC Docket. It should be pointed out that, due to adjacent channel interference, there probably will not be 238 usable frequencies in each channel allotment. This is a theoretical figure based on bandwidths of 25 kHz beginning 37.5 kHz from

Table 4-26

Proposed FCC Assignments for Land Mobile Use of UHF-TV Frequencies in Illinois

	FREQUENCY BAND (MHz)	T.V. CHANNEL NUMBER	MAX. POWER (WATTS)	MAX. ANTENNA HEIGHT (FEET)	CLASS STATION	NUMBER OF 25 kHz CHANNELS AVAILABLE
CHICAGO-NORTH WESTERN INDIANA SMSA	482-488	16	20	50	MOBILE	238
	488-494	17	50	50	BASE	238
	494-500	18	50	50	BASE-MOBILE	238
SAINT LOUIS SMSA*	470-476	14	10	50	MOBILE	238
	476-482	15	100	200	BASE	238
	482-488	16	50	200	BASE	238
	506-512	20	50	50	MOBILE	238

Source: FCC Docket No. 18261.

*Includes Madison and St. Clair Counties, Illinois.

upper band edge and assuming uniform spacing. When the 450-470 MHz band was first assigned in 1950, a similar assignment procedure yielded some 296 total assignable frequencies in the Chicago area.

The history of the 450-470 MHz allocation provides a good case study of just how quickly frequency space disappears once it becomes technologically and economically feasible for land mobile services to use it. Until a few years ago, mobile equipment for use in this band was unstable and difficult to maintain at reasonable levels of operating efficiency. As soon as technical advances ameliorated this problem, the 450-470 MHz frequencies were rapidly applied for and assigned.

In March 1966, the FCC listed sixty-six 450-470 MHz land mobile frequencies as unassigned in Chicago. Within one year only 40 remained unassigned, 16 of which were unusable for normal mobile systems. The remaining 24 frequencies are expected to be used up rapidly. The nationwide situation is already such that the FCC says "serious congestion exists in the 450-470 MHz band."[9]

The message in all this is that State agencies must act promptly to claim frequency space once it becomes available in the 470-512 MHz bands. The competition from local government, industry, citizens, common carrier, and educational users is vigorous now and promises to get even keener. Therefore, as soon as the FCC designates Public Safety allocations in the new UHF bands, both the State Police and the Division of Highways should move quickly to submit their technical proposals to the appropriate area frequency assignment committee. This study concludes that the acquisition of new land mobile frequencies is the only satisfactory alternative open to state government in meeting its radio requirements to 1975.

This does not mean that State agencies should relinquish their present operating frequencies. On the contrary, the proposals described below assume that UHF channels will be used in addition to frequencies already assigned in the

Public Safety bands. The UHF frequencies, as stated earlier, are regarded as the solution to the particularly acute frequency congestion situation in greater Chicago; elsewhere in Illinois, at least through 1975, present frequency assignments are felt to be adequate to meet requirements. The concluding portion of this section deals with the post 1975 technical improvements that may promise more permanent long-term relief.

UHF Frequency Options

Table 4-27 summarizes two options that are open to the State Police and the Division of Highways in utilizing UHF assignments in Metropolitan Chicago. Option No. 1 assumes a request for only enough frequency space to maintain present standards of operating efficiency in the land mobile networks. This means that the present average ratio of mobiles to base stations would continue through 1975. For the State Police, this ratio is about 67 vehicles per base; for Highways, it is about 126 per base. Of course, many vehicles in the Division of Highways network may be performing routine maintenance that does not call for the rapid dispatch turnaround time required by State Police law enforcement cruisers.

Under Option No. 1, the State Police would request four UHF frequencies out of the Chicago-Northwestern Indiana allocation. These additional frequencies would require the construction of one additional base station to provide coverage for the projected requirement of 46 more mobile units. The use of four frequencies on a single-station network will provide increased land mobile communications capability, since it will allow for separate mobile-mobile, base-base, mobile-base, and base-mobile frequencies. Presently, the State Police are using two frequencies to provide these services. Since the operating range in the UHF frequencies is only about five miles for mobiles, Option No. 1 specifies four new repeater stations as necessary to achieve satisfactory coverage.

Table 4-27

UHF Frequency Options for State Mobile Broadcasting In Metropolitan Chicago

AGENCY	MOBILE UNITS		BASE STATIONS			REPEATERS			FREQUENCIES		
				1975			1975		IN USE	UHF REQUIRED 1975	
	1968	1975	1968	Option 1	Option 2	1968	Option 1	Option 2	1968**	Option 1	Option 2
State Police	270	316	4	5	6	2	6	8	4	4	8
Division of Highways	377	434	3	4	6	8	10	12	4	4	10
TOTAL	647	750	7	9	12	10*	16	20	8	8	18

*Two State Police and six Division of Highways repeaters are point-to-point microwave on 960 MHz. Two Division of Highways point-to-point transmitters operate on 450 MHz.

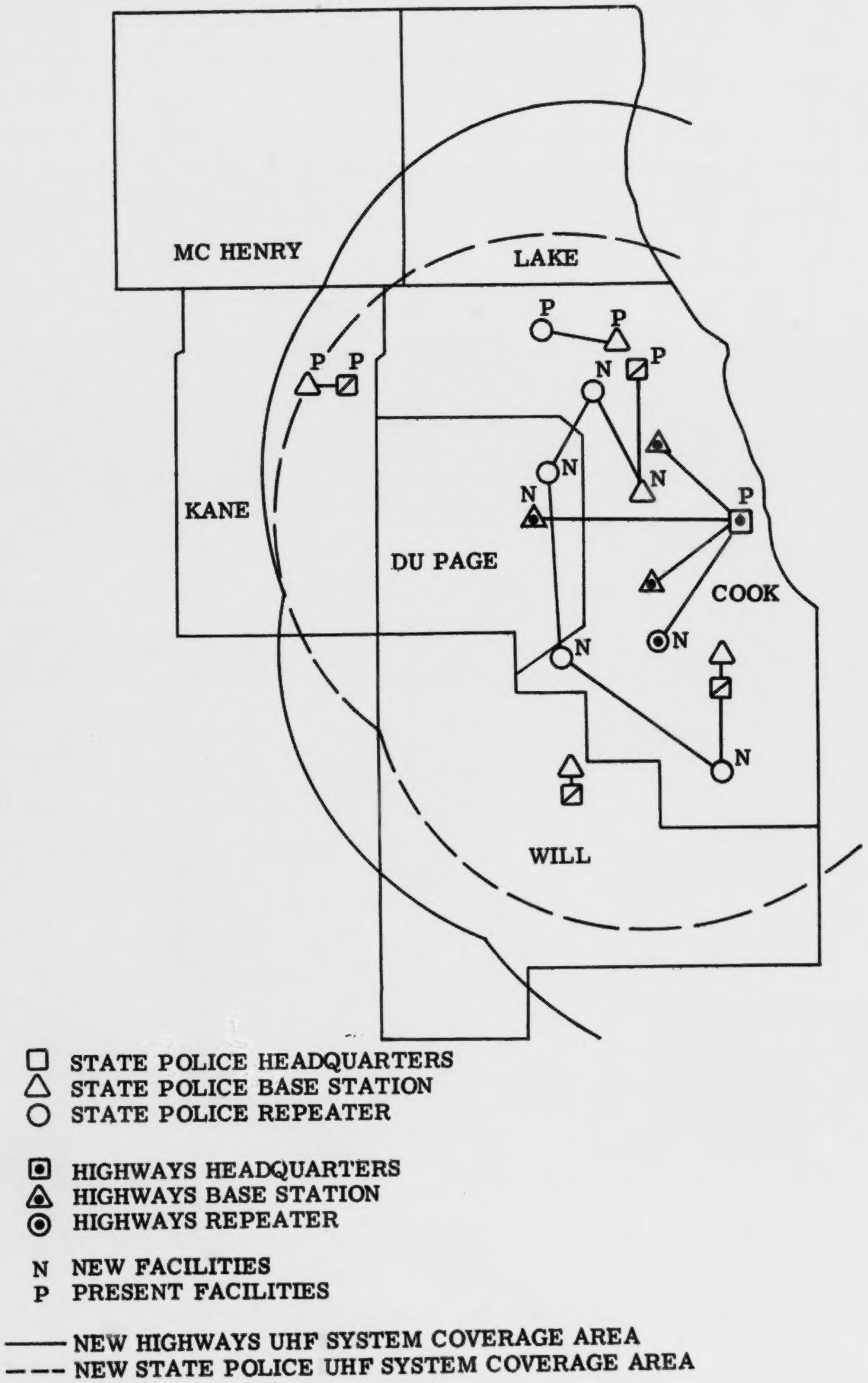
**Operational mobile frequencies in the 42.52-42.76 MHz, 47.30-47.38 MHz, and 150.995-146.120 MHz ranges.

The Division of Highways requirements would closely parallel those of the State Police under Option No. 1. Highways would request four frequencies and construct one new base station that would operate with the same network characteristics as the State Police UHF network. The Division would add two repeater stations to its present total of eight.

Option No. 2 is a more ambitious program for both agencies, since it reduces the number of mobile units per base station in an effort to achieve an improved standard of operating efficiency. For the State Police, this standard is the 50 units per base cited by FCC technical committees as a reasonable operational standard. To accomplish this reduction, the State Police, under Option No. 2, would request eight UHF frequency assignments. Using the same mode of UHF operation described for Option No. 1 (four frequencies per base station), the State Police could then redistribute their vehicles and obtain a reduced ratio of mobile units per base station. This expanded UHF operation would require the addition of six repeater stations instead of the four cited under Option No. 1.

For the Division of Highways, Option No. 2 would bring the Metropolitan Chicago radio networks into line with mobile-base station ratios in other districts in the State. Generally, this ratio is about 70-75 vehicles per transmitter. This standard can be obtained in the Chicago area through the assignment of six UHF frequencies operating in the same mode as Option No. 1. Highways would have to construct four repeater stations to realize adequate coverage with the UHF bands.

Figures 4-8 and 4-9 provide a theoretical placement of UHF base stations and repeaters under Option Nos. 1 and 2 for Metropolitan Chicago. These figures are representational and are provided for the convenience of the reader in visualizing present radio networks augmented by UHF facilities. The drawings are not intended as engineering work-ups. Such technical considerations as base station site location and repeater placement are the province of the respective radio-using agencies.


MC HENRY
LAKE
KANE
DU PAGE
COOK
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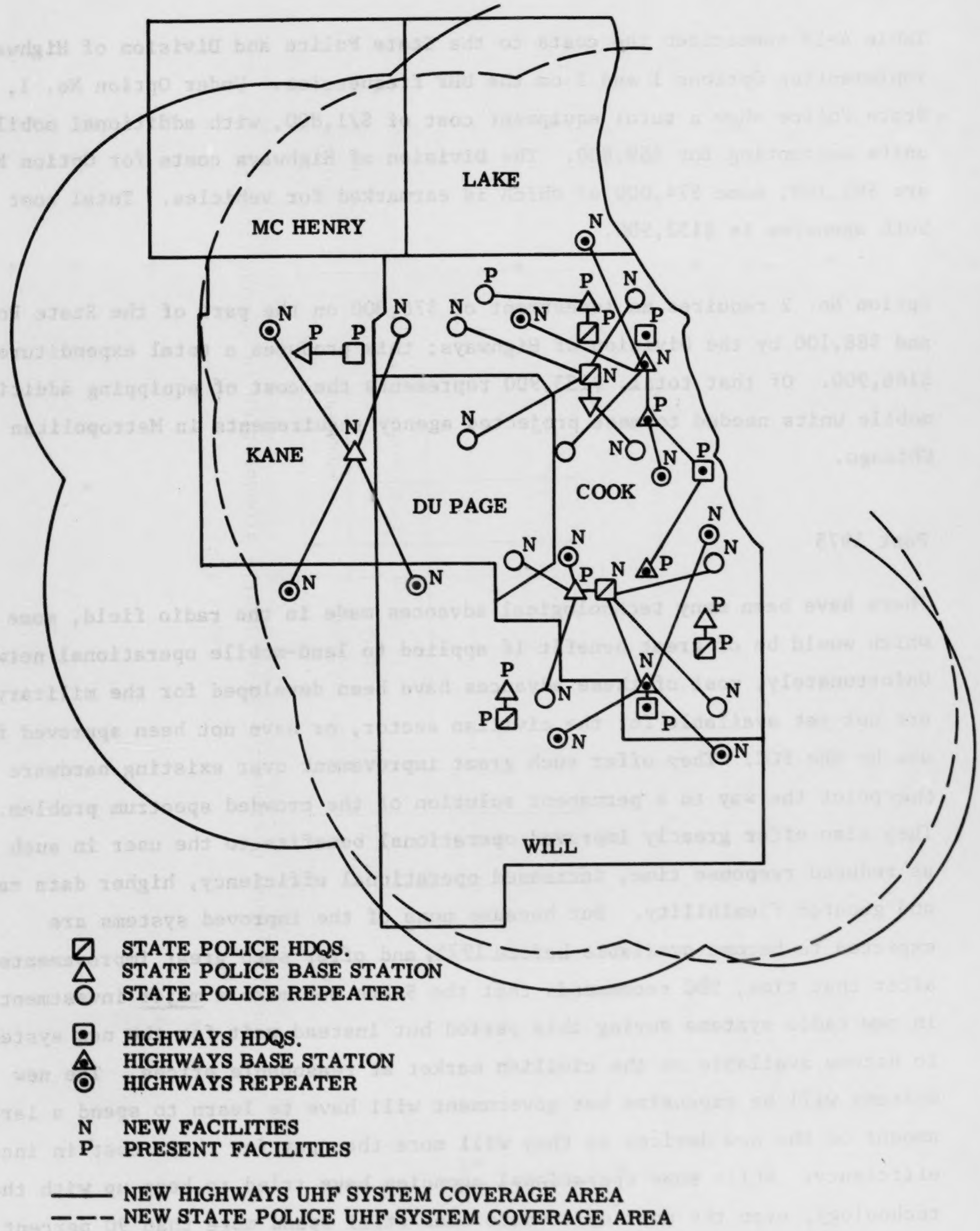
P
N
□ STATE POLICE HEADQUARTERS
△ STATE POLICE BASE STATION
○ STATE POLICE REPEATER
▣ HIGHWAYS HEADQUARTERS
▲ HIGHWAYS BASE STATION
◉ HIGHWAYS REPEATER
N NEW FACILITIES
P PRESENT FACILITIES
—— NEW HIGHWAYS UHF SYSTEM COVERAGE AREA
– – – NEW STATE POLICE UHF SYSTEM COVERAGE AREA

Figure 4-8

Theoretical Placement of Base Stations and Repeaters Under UHF Option 1


LAKE
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△ STATE POLICE BASE STATION
○ STATE POLICE REPEATER
⊡ HIGHWAYS HDQS.
▲ HIGHWAYS BASE STATION
◉ HIGHWAYS REPEATER
N NEW FACILITIES
P PRESENT FACILITIES
—— NEW HIGHWAYS UHF SYSTEM COVERAGE AREA
– – – NEW STATE POLICE UHF SYSTEM COVERAGE AREA

Figure 4-9

Theoretical Placement of Base Stations and Repeaters Under UHF Option 2

Table 4-28 summarizes the costs to the State Police and Division of Highways of implementing Options 1 and 2 on the UHF frequencies. Under Option No. 1, the State Police show a total equipment cost of $71,800, with additional mobile units accounting for $59,800. The Division of Highways costs for Option No. 1 are $81,100, some $74,000 of which is earmarked for vehicles. Total cost for both agencies is $152,900.

Option No. 2 requires an investment of $78,800 on the part of the State Police and $88,100 by the Division of Highways; this produces a total expenditure of $166,900. Of that total, $133,900 represents the cost of equipping additional mobile units needed to meet projected agency requirements in Metropolitan Chicago.

Post 1975

There have been many technological advances made in the radio field, some of which would be of great benefit if applied to land-mobile operational networks. Unfortunately, most of these advances have been developed for the military and are not yet available for the civilian sector, or have not been approved for use by the FCC. They offer such great improvement over existing hardware that they point the way to a permanent solution of the crowded spectrum problem. They also offer greatly improved operational benefits to the user in such areas as reduced response time, increased operational efficiency, higher data rate, and greater flexibility. But because none of the improved systems are expected to become available before 1975, and offer such great improvements after that time, SDC recommends that the State not make a major investment in new radio systems during this period but instead wait for the new systems to become available on the civilian market at reasonable prices. The new systems will be expensive but government will have to learn to spend a larger amount on the new devices as they will more than pay for their cost in increased efficiency. While some operational agencies have tried to keep up with the new technology, even the most up-to-date ones still spend more than 90 percent of

Table 4-28

1975 Projected Costs for UHF Radio Operations--Option Nos. 1 and 2

AGENCY	BASE STATIONS		REPEATERS		MOBILES		TOTAL
	NO.	COST	NO.	COST	NO.	COST	
OPTION NO. 1							
STATE POLICE	1	$ 2,000	4	$10,000	46	$ 59,800	$ 71,800
DIVISION OF HIGHWAYS	1	$ 2,000	2	$ 5,000	47	$ 74,100	$ 81,100
TOTAL	2	$ 4,000	6	$15,000	103	$133,900	$152,900
OPTION NO. 2							
STATE POLICE	2	$ 4,000	6	$15,000	46	$ 59,800	$ 78,800
DIVISION OF HIGHWAYS	2	$ 4,000	4	$10,000	47	$ 74,100	$ 88,100
TOTAL	4	$ 8,000	10	$25,000	103	$133,900	$166,900

their budget on personnel and less than 10 percent on communications, computers and other devices for increasing the efficiency of their operations. The trend of the future will be towards a redress of this imbalance. Those applications most useful for State land mobile operations are discussed below.

Multiple Frequency Trunking

The main problem is that overcrowding of channels for operational use results in lengthy delays for high priority messages. A solution must be aimed toward increasing the probability of obtaining an unused channel when needed. Multiple frequency trunking offers a solution to the problem of overcrowded frequency spectrum by getting higher utilization of all assigned frequencies. This is the principle on which telephone networks operate to provide a high grade of service (one busy signal per 100 tries) with only 15 to 20 percent of the trunks that would be necessary to provide service to all subscribers simultaneously.

The probability of a channel being busy at any instant is directly related to the total traffic loading on the channel. Where a number of users must use a single channel the probability that the channel will not be available when needed is directly proportional to the loading. As the number of channels that are available to the group of users increases, the probability of no channels being available when needed goes down, even though the average load per channel remains the same as the load on the single channel. The dramatic increases that may be expected in channel availability when additional channels are made available to common users is illustrated below.

Probability of No Channel Available[3]

System Traffic Loading	Single Channel	Two Channels	Four Channels
30%	30%	14%	3%
40%	40%	23%	9%
50%	50%	33%	17%
60%	60%	45%	29%
80%	80%	71%	60%

Exactly the same principle applies to a radio network where common channels are made available to a number of users. The hardware required is much more complex than present day mobile equipment and is expected to be from 1.5 to 3 times as costly.[3] The key to the operational system is an automatic channel selector that selects an unused channel for transmission automatically and without effort on the part of the user. The AT&T mobile dial telephone system is an example of a multiple channel random access system that is in operation today.

Many aspects of the Random Access Discrete Address (RADA)* Communication System, planned for the U. S. Army, are ideal for a multiple frequency trunking system suitable for the police and highway nets of the State. RADA, which is presently scheduled for implementation by ground combat forces in FY 1976, is an automatic dial radio system for use by an army division. It operates in the 350 to 400 MHz government band with a basic channel bandwidth of 50 kHz. It will provide for 2,000 users per division and can handle 400 simultaneous calls. The channels will accommodate voice and teleprinter. Mobile units may call each other directly or will be automatically relayed through retransmission units (repeaters) to the called party. The average time to establish a call is 8.3 seconds (63 percent of the calls are established directly in an average time of 1.9 seconds). Calls relayed through retransmission units average 20.7 seconds. RADA has busy override and conference features and affords a measure of privacy comparable to that of wire telephone channels.

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*Under development by Martin Marietta Corporation, Orlando, Florida.

RADA may well be the prototype of all multiple channel random access systems of the future although a civilian version of RADA could omit many of the special features required by the military. No cost estimates for such civilian systems are available now, although it is believed the system will be expensive when it does become available.

There are limitations to multiple channel trunking other than technological. In answer to SDC's request for an informal FCC policy statement on assigning frequencies for multiple use, the response was that a major overhaul of the policies that FCC uses in allocating frequencies will have to be made before such assignments are possible. It was the unofficial opinion of the FCC informant that such a major change would not be made until the frequency situation became far worse than it is today and that when such a change was made, it would take up to ten years to make the changeover.* The indications are therefore, that this solution to the frequency congestion will not be available until well beyond 1975.

Digital Communications Techniques

Vehicular teleprinter offers a means of increasing the information flow in operational networks, particularly from the base station to the mobile units. Teleprinters are particularly attractive from a technical standpoint since they have a very small bandwidth requirement and can be piggybacked onto an existing voice channel. A 300 Hz bandwidth is enough to operate prototype models of proposed equipment, and this bandwidth can be taken out of the several thousand Hz bandwidth assigned to a voice radio channel with negligible loss of voice intelligibility. Since it can thus be sent over a voice channel without affecting the spoken message, it in effect provides an extra channel to all mobile units without requiring any more frequency spectrum space than is presently used for the voice alone.

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*Source: Duncan Peters, Industrial Radio Branch, FCC.

Properly used it can add greatly to the effectiveness of the communication link. Lower priority traffic such as up-dated stolen car lists can be sent simultaneously with higher-priority operational messages, and a hard copy is available without effort on the part of the mobile crew. Messages can be sent while the mobile unit is unoccupied or in motion and the hard copy is particularly effective in high ambient acoustical noise situations where voice reception from a loudspeaker is difficult.

Though still in the R&D stage of development, prototype units have been field tested under simulated operational conditions.* The prototype printer was compact in size, measuring 8 inches wide, 6 inches high, and 10 inches deep. It was a nonmechanical device designed for a vibration and shock environment so did not require shock mounting. Ultimately, with the development of a two-way teleprinter capability the mobile unit in the field could make direct inquiries into the central computerized data bank for information on police or highway matters without requiring a manual relay through the dispatcher. This capability would also improve the traffic load on the voice channel.

Some form of teleprinter equipment will probably become available before 1975, so the State should determine if the added capability is worth the cost and if the teleprinter equipment will be compatible with the present radio equipment. As no operational equipments are presently available, the question cannot be answered in advance.

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*Tests were conducted in January 1967 by the Codamite Division of the Pacific Ordnance and Electronics Company in Anaheim, California, and in February 1967, in cooperation with the General Electric Company Communications Department at Lynchburg, Virginia.

Car Location Systems

A system for keeping headquarters continuously informed of the geographical location of all cars is also recognized to be an important link in any improved command/control capability. This need has been formally recognized by the Science and Technology Task Force of the President's Commission on Law Enforcement and the Administration of Justice. The ultimate objective of such a system is to optimze the selection of the "best" unit to respond to a crime report in terms of the shortest response time. The task force produced a design concept for such a system that will require millions of dollars and several years to develop. There are other systems under development, including one at SDC, but not enough is presently known of the prospective benefits and costs to make a judgment at this time on whether the State Police or Highway Division should acquire this capability. It is certainly a capability that these state agencies might want to obtain when they become generally available and reasonable in cost. However, they will make an additional demand on the radio spectrum. Their bandwidth (and cost) will be related to the accuracy and precision required for an optimized command control system and may vary from area to area if the basic requirements differ. Uncertainties in this requirement seem to have delayed police commitments to major changes in their communications systems.

A "Minimum Cost" Microwave Approach to Intercity Service

Historically, private microwave systems have been installed in only three sets of circumstances: (A) When terrain or other conditions make other techniques impractical so microwave must be used regardless of cost, (B) When the user believes that his requirements for close control of his communications channels are more important than a possible cost penalty, and (C) When the route length and circuit density actually make a microwave system cheaper than other techniques. Illinois does not have terrain or weather bad enough to make (A) apply, and some consideration is given to (B) in Parts Five and Six of this Report, but (C) had to be investigated as a possible approach for the state to pursue.

As a general rule, private microwave costs become more favorable when compared to common carrier tariffs as the mileages and circuit quantities increase. Most of the microwave costs are at the originating and terminating ends because of the multiplexing equipment required there, so the longer the route, the lower the cost per mile. Common carrier tariffs are almost always on a cost-per-mile basis with no discount for distance. Both private microwave and common carriers have "discounts" for circuit quantity, however. The cost per channel of multiplex equipment decreases as the channel count increases and the common carrier tariffs offer the Telpak bulk service rate for large groups of channels. In addition, the GSA Telpak being used in parts of Illinois offers an even cheaper bulk rate.

These interacting factors make it extremely difficult to develop a parametric cost model that will say "If the product of mileage times circuit quantity is greater than X, then the microwave is cheaper." To test the economics of choice in Illinois, the most promising route segment from the standpoint of both reasonably long mileage and large number of circuits was costed for both microwave and common carrier tariffs.

Tables 4-29 and 4-30 show an annual cost for State-owned microwave for the high density traffic from Springfield to Chicago to be $230,131 for P-1 service and $222,303 for P-10 service. The common carrier Telpak D cost is $180,360 annually for P-1 service and $176,000 for P-10 service. The state-owned microwave cost is therefore 28 percent higher annually for P-1 service and 26 percent higher for P-10 service.

Since the private system cannot compete economically with the common carrier under the best set of route conditions, it would be even worse for other parts of the State. The idea of designing a "minimum cost" microwave system was therefore discarded as a reasonable alternative.

Table 4-29

Microwave Costs-Chicago to Springfield High Density Traffic Corridor

Voice and Data Traffic 1975

				P-1						
LOCATION	LAND, TOWER, BLDG.	ANTENNAS	REPEATER EQUIP.	CHANNEL ROMT.	UNIT CAPACITY	MUX. COST	CHNL COST	EQUIP. COST	INSTALL 20% EQUIP.	TOTAL P-1
Springfield	$23,500	$2,000	$ 7,750	240	240	$185,520	$22,080	$217,350	$43,470	$283,320
Chicago	23,500	2,000	7,750	240	240	185,520	22,080	217,350	43,470	283.320
Repeater Sta. 1	23,500	4,000	15,200	-	-	-	-	-	3,840	46,540
Repeater Sta. 2	23,500	4,000	15,200	-	-	-	-	-	3,840	46,540
Repeater Sta. 3	23,500	4,000	15,200	-	-	-	-	-	3,840	46,540
Repeater Sta. 4	23,500	4,000	15,200	-	-	-	-	-	3,840	46,540
										$752,800

				P-10						
LOCATION	LAND, TOWER, BLDG.	ANTENNAS	REPEATER EQUIP.	CHNL UNIT RQMT.	MUX UNIT	MUX COST	VOICE CHNL COST	EQUIP. COST	INSTALL 20% EQUIP.	TOTAL P-10
Springfield	$23,500	$2,000	$ 7,750	228	228	$177,612	$20,976	$208,336	$41,667	$272,503
Chicago	23,500	2,000	7,750	228	228	177,612	20,976	208,336	41,667	272,503
Repeater Sta. 1	23,500	4,000	15,200	-	-	-	-	-	3,840	46,540
Repeater Sta. 2	23,500	4,000	15,200	-	-	-	-	-	3,840	46,540
Repeater Sta. 3	23,500	4,000	15,200	-	-	-	-	-	3,840	46,540
Repeater Sta. 4	23,500	4,000	15,200	-	-	-	-	-	3,840	46,540
										$731,166

Table 4-30

Cost Comparison--State-Owned Microwave vs. Common Carrier Telpak
High Density Voice and Data Traffic Between
Springfield and Chicago--1975

	P-1	P-10
STATE-OWNED MICROWAVE		
Equipment Cost from Table 4-29	$ 752,800	$ 731,166
15% Accessories and Spares	84,996	81,750
5% Accessories and Spares Balance of Sites	9,308	9,308
TOTAL	$ 847,104	$ 822,224
Interest 5%	377,031	365,971
Maintenance 10%	1,270,650	1,233,330
Lost Taxes 2.5%	179,586	174,311
Total 15 Year Life Cost	$2,674,371	$2,595,836
Annual Cost	178,291	173,055
Leased Line-Local Terminations Annual Cost	51,840	49,248
TOTAL ANNUAL COST	$ 230,131	$ 222,303
TELPAK D - IBT TARIFF		
($45.00 per Airline Mile, $15.00 Termination Charge at each end--Capacity 240 Lines)		
240 Lines--P-1 (174 Miles)		
Mileage (Annual)	$ 93,960	
Termination Charges (Annual)	86,400	
228 Lines--P-10 (174 Miles)		
Mileage (Annual)		$ 93,960
Termination Charges (Annual)		82,080
TOTAL ANNUAL COST	$ 180,360	$ 176,040

Communication Satellites

A communication satellite has the potential to provide highly reliable and economic transmission and/or relay of electromagnetic radiation across great distances. Thus, the communication satellite must be considered a competitor to ground-based facilities for long distance point-to-point communications. This section considers the technical and economic feasibility of utilizing the communication satellite to meet the State's needs for point-to-point telecommunications.

Technical Aspects

Communication satellites can be of the active or passive type, placed in controlled or random orbits. Controlled orbits are generally synchronized by velocity control to place the satellite over a given point on the earth at regular times each day. When the orbital period (time in hours for one orbit) of a controlled satellite is made equal to the time required for the earth to make one revolution (approximately 24 hours), the satellite can be made to remain stationary over any point on the earth's equator.

The simplest type of communication satellite is a passive reflector. Electromagnetic signals from a transmitter at one earth terminal are beamed at the satellite, which reflects them to earth terminals. Since technology considerations limit the size and shape of the reflector, this type of relay is usable only with powerful transmitters and large receiving antennas and the satellite is suitable only for point-to-point service.

The active satellite is one containing transmitting and receiving equipment and can function as: (1) a point-to-point relay, (2) a direct broadcasting point, (3) a point-to-mobile relay, and (4) a mobile-to-mobile relay.

The dominant characteristic for the use of satellites for communications is the field of view of the earth's surface from the satellite. A 24-hour synchronous satellite "sees" nearly one-half of the earth's surface all the time. Within this field of view, the satellite is capable of providing reliable transmission or relay by line-of-sight using the frequency spectrum above 100 MHz.

Applications

For commercial communications use, only the so-called active stationary satellite (the 24-hour synchronous satellite with an on-board transmitter) is of practical value. This type of satellite can be used for both the networking and the distribution of electromagnetic radiation.

The network function is achieved by using the satellite as a relay in the same manner as a microwave repeater. A signal from a ground station is received by the satellite, amplified to a power of several watts, shifted to a different frequency and retransmitted back to earth. A single 24-hour synchronous satellite is capable of relaying one or more channels of electromagnetic radiation to very nearly hemispherical coverage of the earth.

The distribution of electromagnetic radiation is achieved via satellite by using an on-board transmitter and antenna. Functionally, the direct transmitting satellite would receive signals from one or more master ground stations, and the signals would be amplified, shifted in frequency, and directed by satellite antenna toward the desired regions of the earth. The signals transmitted by the satellite would be received by locally installed antennas in the same manner as signals from conventional earth-based broadcast stations.

Functionally, communication satellites cannot do anything that cannot be done in more traditional ways. However, they make it possible to span long distances at very low costs and therefore change the economics of long-distance communications. With communication satellites the cost of point-to-point communications is essentially independent of distance; it costs just as much to communicate with someone ten miles away as it does to communicate 10,000 miles.

Advantages and Limitations

The most obvious advantage of the communication satellite is its field of view. This field of view: (1) allows the use of frequencies above 100 MHz for long-distance communications, (2) greatly reduces the number of repeaters required for point-to-point networking, (3) eliminates many of the interference problems of ground-based broadcasting antennas, (4) allows communication with points difficult to reach by conventional cable or microwave techniques, and (5) provides a communication link whose cost tends to be independent of distance.

Satellite transmitter power and antenna size are factors that must be manipulated within the satellite weight constraints. These two factors, likewise, directly affect the size of the required ground-based receiving antenna, as well as the sensitivity of the receiver. Current satellite relays employ ground stations costing over $100,000 each. Direct broadcasting via satellite is limited by the allowable costs of the home receiving stations. Due to the large number of home receivers involved, it is desirable that receiver and receiving antenna costs be kept under $200. To achieve this, the satellite transmitter would have to be capable of putting out about one kilowatt, an output that is not now practical, although several approaches to this capability are under development.

A related problem is that the field of view is too large, thus wasting power. Coverage possible with satellites greatly exceeds what is needed to meet projected requirements within the boundaries of Illinois. To concentrate this coverage for maximum effectiveness in the state, considerable work remains to be done in designing satellite antennas and power supplies. While the aerospace industry is recording many advances in these areas, the state-of-the-art is a long way from overcoming these obstacles.

An additional limitation of the 24-hour synchronous satellite is the time required for a signal to travel from the transmitting station to the satellite and back to a receiving station. This time is 0.26 seconds or about eight times that incurred in a submarine cable between New York and London. In a real-time two-way telephone connection, where the satellite is used to relay messages in both directions, the echo affect produced by the delay time tends to limit free conversation and exchange. Because of the difficulty of controlling echo, it is current practice to limit satellite relayed telephone connections to one direction and to use terrestrial transmission facilities for the return direction. For one-way communications and non-real time communications this aspect of satellites is not a problem.

Other limitations of communication satellites are:

- Communication satellites create substantial frequency interference problems due to their large field of view.

- Present frequency allocations for satellite usage are: the 3700 to 4200 MHz for earth-to-satellite transmissions, and 5925 to 6425 MHz for satellite-to-earth transmission. These frequency bands are not compatible with direct television broadcasting in the United States. Special receiving sets or converters would be required for this type of source.

Satellite Communication Applications to Illinois

Theoretically, it appears possible to meet all of Illinois telecommunication requirements--except local telephone service--through the use of a communication satellite system. Such a system would require one or more multiple channel satellites capable of functioning as both a relay and a broadcasting transmitter with the capability of being concurrently utilized by many ground stations.

While communication satellite technology has advanced considerably over the past five years, satellites with the capability to meet the above requirements do not yet exist. In addition, the frequency allocation and conversion problems associated with such a large system plus the investment required for a large number of ground stations make such a system economically unrealistic.

One area of potential application of communication satellites to meet a telecommunication need for Illinois is in the transmission and/or distribution of educational television. Current educational television requirements have established the need for a Statewide multiple channel network. This network consists of approximately 5,000 channel miles of surface microwave or cable installations. The feasibility of utilizing a communication satellite system to meet the State Educational Television requirements are presented in the remainder of this subsection.

ETV Satellite Relay

The proposed Illinois microwave ETV network connects a total of 15 ETV broadcasting sites and covers a distance of about 1500 miles. The use of a relay satellite as a four-channel interconnection for all of Illinois ETV broadcasting stations could replace all of the microwave repeaters. A combination receiving and transmitting ground station would be required at a minimum of six State Universities where ETV broadcasting stations are located. These are:

Northern Illinois University at De Kalb

Western Illinois University at Macomb

Illinois State University at Normal

University of Illinois at Urbana

Eastern Illinois University at Charleston

Southern Illinois University at Carbondale

The 15 ETV broadcasting sites would require ground receiving capability only.

The annual amortized costs (neglecting cost-of-money) of a four-channel synchronous satellite relay system, having a ten-year life and capable of limiting its coverage to slightly more than 15° of longitude (roughly one time zone), are estimated to be $4.2 million. This figure is based upon the following:

Requirement	Initial or Annual Cost ($)	10-Year Cost ($)
Three satellite launches (expected life per satellite--3-to-5 years)	12.5 million each	37.5 million
Construction, operation, and maintenance of 15 ground stations	30,000 per annum ea.	4.5 million
TOTAL		$42.0 million

ETV Direct Broadcasting Satellite

In a direct broadcasting satellite ETV system, television signals would be transmitted to the satellite from one or more master ground stations. After arriving at the satellite the signals would be amplified, shifted in frequency, and directed by satellite antenna back to the earth where they would be received and viewed in homes and schools. Ideally, conventional home TV receivers should be used, but this would require substantial receiver modification and changes in current FCC frequency allocation policies. Consequently, it is likely that special receivers will limit the initial use of the satellite system to an instructional television function.

The most significant cost components of a direct broadcasting television system are the master ground stations, satellite development, launch operations and ground receiving facilities.

Aerospace companies contacted indicated that the cost of special receivers to be used with a direct broadcasting satellite system would approach $1,500 even when produced in mass quantity. These same companies indicated that the cost of developing and launching a four-channel direct broadcasting satellite would range from 40 to 160 million dollars. Such a satellite could weigh as little as 1,000 pounds or as much as 4,000 pounds.

The total costs of a four-channel direct broadcasting satellite system, having a ten-year life, with six master ground stations and serving 10,000 receivers, is estimated at a minimum of $136.8 million. This figure consists of $120 million for satellite development and launch, $1.8 million for master ground stations, and $15 million for receivers. The cost of receiver maintenance is not included. The value of 10,000 receivers is conservative for Illinois. Within the state are 3,650 elementary schools, 345 junior high schools, and 811 high schools. Allowing only two TV receivers for each of these schools requires a total of 9,612 sets. This does not include the sets required for junior and senior colleges.

Conclusions

While it is technically possible to use satellites for ETV networking and distribution in Illinois, it is not economical to do so. Ground-based facilities such as microwave and coaxial cable are substantially lower in cost than current satellite systems. It appears that satellites will only become economical when R&D costs are reduced sufficiently to allow substantial reduction in launching costs. It is recommended that ground-based facilities be utilized to meet the state ETV requirements through 1975.

Community Antenna Television (CATV)

The Statewide microwave educational television networks discussed in this report provide for broadcast coverage via 16 ETV broadcasting stations. The locations of these stations are such that the total state is covered by at least one ETV channel. In addition to the broadcast coverage, a design goal stated by the Superintendent of Public Instruction is to eventually have multichannel distribution "off-net" to every school in the state. This may be done in different ways for different parts of the State but the most likely techniques will be Instructional Television Fixed Service (ITFS), leased lines from the common carriers, or Community Antenna Television (CATV). An economic comparison for choice in each community will have to be done when the requirements for each community are defined. The Jansky and Bailey study contains an excellent parametric cost analysis of the various techniques for local distribution on pages 78 to 91 but, as with all costs, they change with time and should be updated before being used. This is especially true in some special pricings being offered by CATV operators for carrying educational materials.

To date, the CATV industry has been cooperative with, and interested in, the educational aspects of television. In Report A of this study, it was indicated that 18 CATV systems in Illinois currently carry one or more ETV signals. In Report B, it was indicated that "certain special interest groups are bringing pressure to bear on the FCC to require cable operators to provide free distribution to schools within the CATV service area." The State should follow closely all FCC actions relating to CATV systems for local distribution of educational materials.

This Report has investigated CATV for still another application in the State's distribution network, i.e., could use be made of existing CATV systems to take the place of proposed microwave route segments. Table 4-31 shows that Illinois now has 38 CATV systems in operation--representing a sizeable investment on the part of private industry--and it was felt that the State should take

Table 4-31

Community Antenna Systems in Illinois (1968)

Beardstown
Belvidere
Centralia
Charleston
Danville
DeKalb - Sycamore
Dwight
Effingham - Teutopolis
Fairbury
Fairfield
Flora
Galena
Grand Ridge
Hanover
Hoopeston
Jacksonville - South Jacksonville
Joliet
Kankakee
Macomb
Mattoon
Morris
Mt. Vernon
Newton
Olney
Ottawa - Marseilles, Naplate
Paris
Peru - LaSalle, Mendota, Oglesby, Spring Valley
Pontiac
Robinson
Rochelle
Salem
Springfield - Grandview, Jerome, Rochester, Leland Grove, Southern View
Streator - Bruce Twp., Eagle Twp., Ottor Creek Twp., Reading Twp.
Taylorville
Vandalia
Watseka
Westville - Belgium, Central Park, Hegoler, Home Gardens, Tilton
Keokuk, Iowa - Hamilton, Illinois

Source: Television Factbook
Television Digest, Inc.
Washington, D. C.
1968-1969 Edition/No. 38

advantage of these facilities wherever possible. Unfortunately, this approach is not very promising because of the nature of CATV operations.

First, in order to replace a route segment, a CATV system would have to lie approximately along the proposed microwave route for at least 20 miles, the length of one microwave hop. But CATV is essentially an "area" coverage, not a "distance" coverage because it serves a small community in a roughly circular pattern. Only a few of the existing systems meet this location and length requirement or are close enough to another one going in the proper direction to consider tying them together.

Second, the cost of the expensive multiplexing equipment for any voice and data channels originating or terminating in that community would still be necessary so not all of the costs of that route segment would be saved.

Third, the CATV operator would have to expand his system's capability to handle the State's additional load. His charge for this may be roughly the same as for the State's alternative ways of covering that same distance.

Fourth, the CATV operator must be licensed as a Miscellaneous Common Carrier in competition with the local telephone company or he cannot carry signals "for hire."

Fifth, CATV systems are independent and (so far) unregulated business. They do not have any required standards for grade of service or reliability so the State would have to expect non-uniform technical performance on those route segments.

Sixth, the State would have a large hidden--but real--cost of negotiating contracts with individual operators and modifying them as the network's circuit requirements change. In addition, the CATV systems, being private business, are subject to sale, merger, or other changes, so the State might have to renegotiate with the new owners, subsidize a money-losing business to keep it going, or replace that segment with its own microwave link like the rest of the system.

Any of these six reasons, particularly the reliability and technical quality ones, would cause a system designer to hesitate before including CATV in plans for the interconnection network. Taken together they make the approach impractical. CATV was therefore discarded as a reasonable alternative for the State to pursue

PART FIVE: COST EFFECTIVENESS ANALYSIS

In this part of the report, the networks that were detailed and costed in Part Four are assembled into seven basic alternative systems that have approximately equal capability for interconnecting the proposed UHF broadcast stations and meeting the other telecommunications requirements of the State. (For total system costs see page 205). The interconnection alternatives are:

- POTS common carrier administrative network with State-owned ETV microwave network.
- POTS common carrier administrative network with leased ETV microwave network.
- POTS common carrier administrative network with common carrier ETV network.
- State-owned combined administrative and ETV microwave network.
- Leased combined administrative and ETV microwave network.
- State-owned administrative microwave network with common carrier ETV network.
- Leased administrative microwave network with common carrier ETV network.

COST EFFECTIVENESS CRITERIA

A cost effectiveness criterion specifies the relation between a measure of effectiveness and a measure of cost, the use of which will result in an indication of preference among the alternatives. The effectiveness measure should express the extent to which the alternative plans under study satisfy the system objectives. The cost measure should be consistent among alternatives.[4] The most widely used criteria for selecting the preferred alternatives in Department of Defense (DOD) cost effectiveness studies are: (1) an equal cost form of analysis which assumes a fixed budget and determines which alternative yields the greatest effectiveness for a given expenditure, and (2) an equal performance form of analysis where the required capability is specified and the alternatives to achieve this capability are compared on the basis of least cost.[5]

When it is not feasible to structure the analysis in either of the above forms, a comparison of incremental effectiveness associated with the incremental increases in the resources required can be made.

The measures of performance used in this study for validating the alternatives are:

- they must provide P-1 grade of service on the administrative voice network. (An alternative P-10 grade of service is also costed and compared.)
- they must meet the priority requirements for the reliable, secure, exclusive-use circuits needed by the State Police, Highways, Mental Health, and Civil Defense agencies.
- they must provide for adequate interconnection of the 15 VHF and UHF ETV transmitter sites with the six State University campus programming centers, and provide the specified number of color TV channels.

DESIGN ADEQUACY

The alternative plans have been selected to approximately meet the operational requirements. Each configuration has been designed to satisfy system objectives as closely as possible within its unique limitations. While the configurations do differ from each other in some measures of performance, they can all be considered to generally meet the operational requirements. This tends to weight the analysis toward number two of the preference criteria, where the required capability is specified and alternatives are compared on the basis of least cost.

A grade of service of P-1 was chosen as the basic effectiveness criterion for the administrative network so that all systems could be compared to the common carrier network which offers P-1 service. From an economic point of view, however, SDC had previously recommended that the State probably could live quite well with a P-10 grade of service (Report A, p. 184) on its long distance trunks. For this reason, the administrative networks have been designed and costed for a P-10 grade of service to determine if the economic savings of using this lesser service is worthwhile.

ALTERNATIVE SYSTEM DESCRIPTIONS

The seven basic alternative systems discussed in this section were established by considering all possible combinations of ownership of the two subsystems (i.e., an ETV network and an administrative network), which together, constitute a total State telecommunication system. Since each subsystem has the possibility of being owned by: (1) a common carrier; (2) the State; or (3) a leasing agency, a total of nine basic alternative systems were possible. Two of these possibilities (1) a leased ETV network with a State-owned administrative network and (2) a State-owned ETV network with a leased administrative network were not costed as the two networks share common hardware to the extent that costs cannot be separated. This means that the financial option (purchase or lease) most suitable for the State must be applied to both networks.

Before presenting a discussion on the comparative aspects of the seven basic alternative systems analyzed, a brief recapitulation of each system and its costing will be given.

POTS Common Carrier Administrative Network with Common Carrier ETV Network

This plan utilizes the common carriers within the State to provide all telecommunication facilities and services except for land mobile radio operations and civil defense radio backup.

ETV requirements are met by the common carrier network described in Part Four which interconnects the 15 broadcasting station sites and the six university campuses. The estimated annual costs for the ETV portion of the configuration is $850,968.

The Administrative requirements are met by a POTS network based on augmenting the present intercity common carrier services and facilities to meet 1975 requirements. It has been assumed that the State will employ management procedures for controlling the unauthorized and uneconomical use of both facilities and services. The annual system costs for all agency normal and priority traffic, excluding data and a special warning system, is estimated to be $793,000 for P-1 service and $612,000 for P-10 service. Data transmission costs for 232 dedicated data lines which exclude the LEADS and Springfield terminals have been estimated at $71,880 per year and the cost of special systems to link all State Police and Civil Defense radio transmitters to the EOC's in Springfield is estimated at $42,000 per year. For P-1 service the administrative portion of this configuration will cost $906,880 per year. For P-10 service the costs will be $725,880 per year.

Combining the two network costs, the estimated annual costs for a total common carrier system are estimated to be

for P-1 service	$1,757,848
and for P-10 service	$1,576,848

POTS Common Carrier Administrative Network with State-owned ETV Microwave Network

This plan utilizes the common carrier POTS network to meet all routine and priority telecommunication requirements except that performed by radio, ETV requirements are satisfied through a State-owned and maintained microwave network.

The administrative network is the same as in the previous plan, the costs for P-1 and P-10 services are $906,880 and $725,880 per year respectively.

The State-owned ETV microwave network is that presented in Figure 4-5, Part Four. This network is a 12-GHz system consisting of 72 station locations, each having a 300-foot tower with antenna and a service building with associated equipment. The cost of this network based on an amortization period of 15 years is estimated to be $829,307 per year.

The total yearly costs of this configuration, both ETV and administrative, are

for P-1 service	$1,736,187
and for P-10 service	$1,555,187

POTS Common Carrier Administrative Network with Leased ETV Microwave Network

This plan consists of a leased 12-GHZ ETV microwave network identical to the State-owned network of the previous plan (Figure 4-5), and a common carrier POTS administrative network also the same as the previous plan. The configuration is physically identical to the previously discussed configuration; only the method of financing the installation and maintenance of the microwave network is different.

The annual cost of leasing the 12-GHz ETV microwave network (taken as 22 percent of the installed cost of the network) is estimated to be $821,667. The POTS common carrier administrative network costs remain at

for P-1 service	$906,880 per year
and for P-10 service	$725,880 per year

Total configuration costs are

for P-1 service	$1,728,547 per year
and for P-10 service	$1,547,547 per year

State-owned Administrative Microwave Network with Common Carrier ETV Network

This plan consists of a State-owned 6-GHz microwave network for administrative and operational traffic and a common carrier supplied ETV network.

The administrative microwave network is that shown in Figure 4-6 in Part Four. The network was designed to include all major intercity normal traffic corridors plus the priority traffic requirements of the State Police, Civil Defense, Department of Highways, and Department of Mental Health. The cost of this administrative microwave network, including that required to provide spurs and terminals for connections to the local common carrier services are: $1,476,815 per year for P-1 service and $1,325,525 per year for P-10 service.

The State's ETV requirements are met through the common carrier distribution network described in Part Four and specified in the first plan described above. The estimated annual costs for this ETV network are $850,968 per year.

Total annual costs of this configuration where ETV requirements are provided by a common carrier and the administrative traffic is via a State-owned microwave network are:

for P-1 service	$2,327,783
and for P-10 service	$2,176,493

Leased Administrative Microwave Network with Common Carrier ETV Network

This plan is physically identical to the previous plan except the State would lease the 6-GHz administrative microwave network rather than own it.

As before, leasing costs are estimated to be 22 percent of initial equipment and installation costs. To this is added the cost of common carrier spurs and terminals making the annual costs to the State of this administrative microwave network for P-1 service equal to $1,440,067. The annual costs for P-10 service is $1,293,517.

As in the previous plan, the annual cost of a common carrier supplied ETV network is estimated to be $850,968.

Therefore, the total costs of this configuration are

for P-1	$2,291,035 per year
and for P-10	$2,144,485 per year

State-owned Combined Administrative and ETV Microwave Network

This plan is based on a State-owned 12-GHz microwave network that meets both the ETV and administrative telecommunications requirements. This combined microwave system is shown in Figure 4-7 in Part Four. The costing figures for this plan are obtained by adding the costs of the State-owned ETV microwave network plus those add-on costs required to meet the requirements of an administrative network.

The annual costs for a State-owned ETV network alone have been given as $829,307 per year. The add-on costs to provide P-1 administrative service are estimated to be $1,321,547 per year. For P-10 service these add-on costs are $1,183,003 per year.

Total yearly cost for a State-owned combined ETV and administrative network are:

for P-1 service	$2,150,854
and for P-10 service	$2,012,310

Leased Combined Administrative and ETV Microwave Network

This plan is physically identical to the State-owned combined network just described. The cost of leasing a combined ETV and administrative 12-GHz microwave network consist of the following: (1) for the ETV portion of the configuration $821,667 per year, (2) for P-1 administrative service $1,290,935 per year and (3) for P-10 administrative service $1,156,425 per year.

Total costs are:

for P-1 service	$2,112,602
and for P-10 service	$1,978,092

COMPARATIVE COSTS

The seven alternative plans that were costed are shown in Figure 5-1 in the form of a bar chart. All seven plans were costed with two grades of service for the administrative network, P-1 and P-10. Plans are arranged in order of overall system cost with the least expensive system at the top. The highest cost system is about 35 percent more expensive than the lowest cost system. The difference between adjacent system costs are as follows:

Adjacent Plans	Cost Difference
1 - 2	0.4%
2 - 3	1.2%
3 - 4	20.2%
4 - 5	1.8%
5 - 6	6.5%
6 - 7	1.6%

It can be seen that the seven systems cluster into three distinct cost groups.

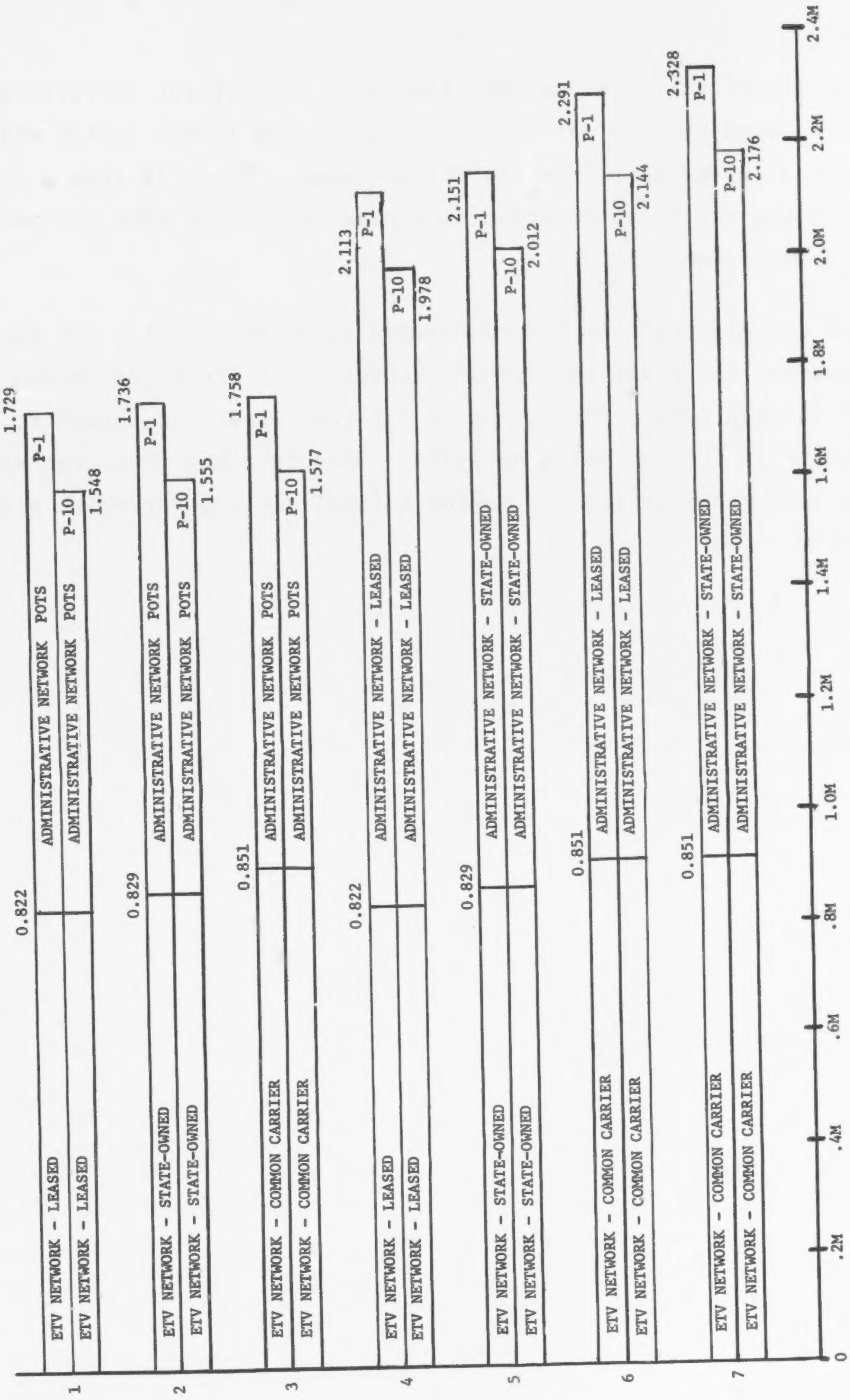


Figure 5-1

Cost Comparisons of Alternative Plans

The three lowest cost systems have less than two percent difference among them. This is followed by a 20 percent cost jump to the fourth system which is separated by less than two percent from the fifth system. There is then a jump of over six percent to the sixth system which is separated by less than two percent from system number seven.

As all of the alternatives are considered to be essentially the same in effectiveness, the preferred system theoretically should be chosen only on the basis of minimum cost. The choice is not that clear cut, however, as will be demonstrated in the following analysis. Factors other than cost will have to be taken into consideration in making a final decision on which plan should be implemented.

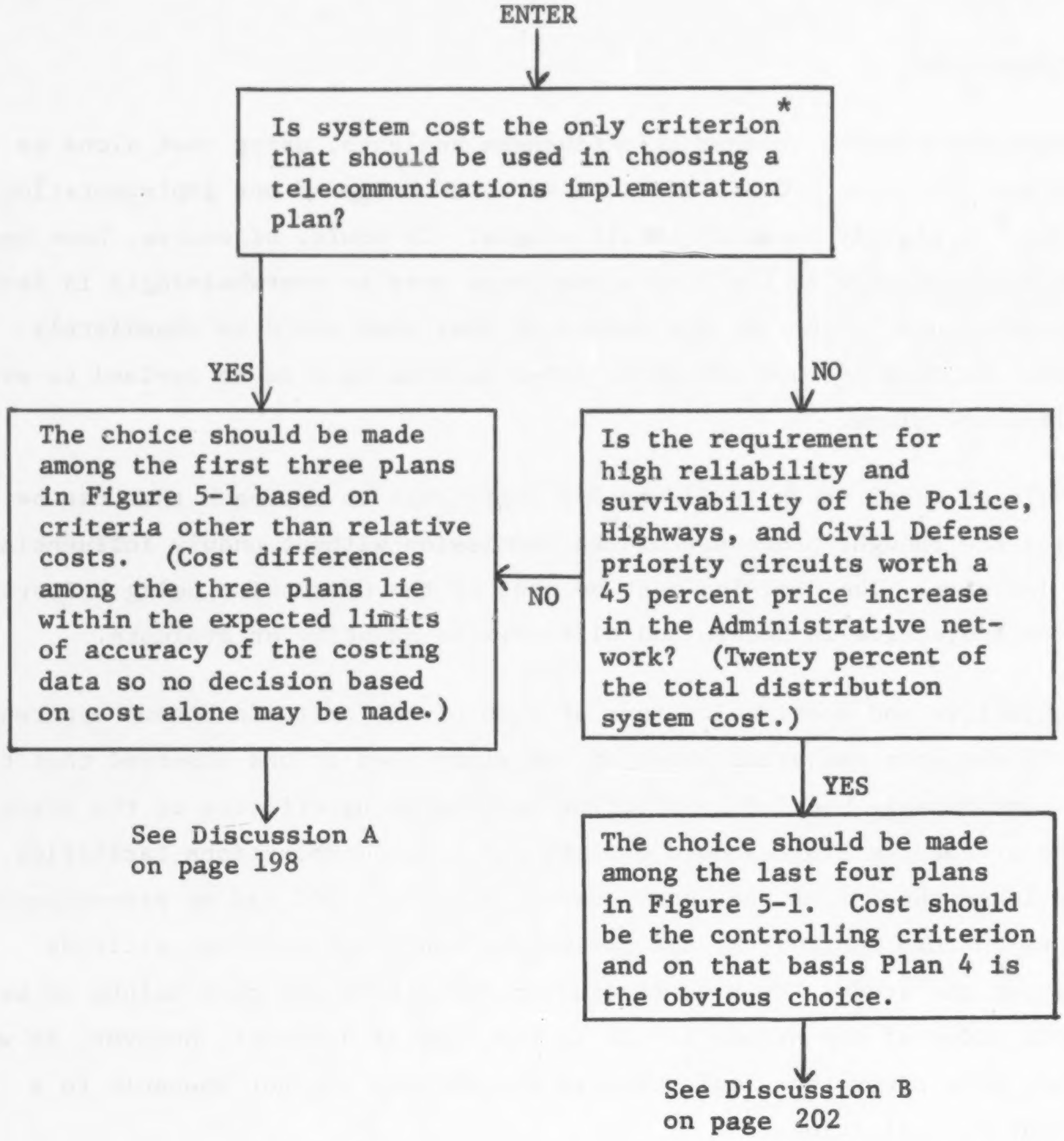
A DECISION MODEL

As frequently happens in cost effectiveness analyses, using cost alone as the comparison criterion did not give a clear cut choice of one implementation plan that is plainly superior to all others. It would, of course, have been much more satisfying if the cost comparisons were so overwhelmingly in favor of one particular plan that the choice of that plan would be immediately obvious. As this was not the case, other methods have to be devised to evaluate the alternate plans.

The decision model shown in Figure 5-2 represents an approach that can be used to guide the thought processes of the Commission without unduly influencing the final decision. The decision must be made by the Commission using criteria that are subjective in nature and difficult to quantify or evaluate.

The subjective and emotional nature of some of the criteria became apparent early in the data gathering phase of the study when it was observed that there was a considerable body of conflicting opinion among officers of the State on whether or not the State should own its own telecommunications facilities or should lease these from the local common carriers. SDC had no pre-conceived opinions on this controversy and has maintained a non-partisan attitude throughout the study. We have recognized that there are good points to be made for both sides of the argument. It is the type of argument, however, in which bias has more power than logic because the factors are not amenable to a quantitative evaluation.

Figure 5-2 can be used as a simple guide to relate the findings of the cost effectiveness study to the basic requirements of the State. Prior to entering



Is system cost the only criterion* that should be used in choosing a telecommunications implementation plan?

The choice should be made among the first three plans in Figure 5-1 based on criteria other than relative costs. (Cost differences among the three plans lie within the expected limits of accuracy of the costing data so no decision based on cost alone may be made.)

See Discussion A on page 198

Is the requirement for high reliability and survivability of the Police, Highways, and Civil Defense priority circuits worth a 45 percent price increase in the Administrative network? (Twenty percent of the total distribution system cost.)

The choice should be made among the last four plans in Figure 5-1. Cost should be the controlling criterion and on that basis Plan 4 is the obvious choice.

See Discussion B on page 202

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*This assumes that all of the plans meet the minimum requirements for ETV coverage at the specified grade of service for the Administrative network.

Figure 5-2

Decision Model for Choosing an Alternative Telecommunications Plan the decision model it is assumed that the following has been established by the study:

- A State ETV broadcast and distribution network is required
- The State needs and is willing to fund a first class telecommunications system*
- All seven telecommunications plans in Figure 5-1 meet the minimum requirements for both the ETV and administrative network

The decision maker enters the decision model at the top and is immediately confronted with a choice. He must answer the question:

Is minimum system cost more important than other intangible benefits?

However, before answering this question the following should be considered.

Administrative Network Implementation

While the differences in costs among the ETV networks were negligible, such is not the case with the comparative costs of the administrative networks. The highest cost system (State-owned) is about 63 percent ($570,000 per annum) more costly than the lowest cost system (POTS). The leased network is almost 59 percent ($533,000 per annum) higher than POTS. These large differences in costs are primarily due to the high costs associated with the terminal multiplex equipment needed to process the voice and data channels as compared to the relatively inexpensive radio equipment needed for TV transmission.

Even when a basic ETV microwave system is assumed to be in existence, just the added cost of supplying the electronic equipment for the needed voice channel exceeds the cost for an equivalent POTS network. (Compare Plans 4 and 5 with Plans 1 and 2.) The reason for the low cost of the POTS network is that the cost for leased lines in Illinois have been averaging a low 76 cents per mile per month due to the extensive use of GSA and State TELPAK tariffs in the higher traffic density corridors.

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* In line with this thinking, all cost comparisons were done using P-1 service in the Administrative network although costs for P-10 service were also calculated.

A choice among administrative networks based on cost alone would definitely be in favor of a POTS system. (It remains to be seen how the IBT proposed network costs compare with the costs developed in this study.) Even though the cost factors are decisively in favor of the common carrier network there is at least one important factor that should be considered in any decision to implement. This is:

Security of Priority Traffic

This consideration is of prime importance to the State Police, Civil Defense, Division of Highways and other agencies and personnel having operational and emergency telecommunications responsibilities. As far as providing priority voice and data channels is concerned, the common carrier system can provide them at a lower cost than either a State-owned or leased system. The matter of security of the priority channels is another question, however. There is a considerable body of conviction among State personnel that the common carrier circuits are more vulnerable to enemy attack, natural disaster and sabotage than is a State-owned microwave system. Whether this is true is hard to prove conclusively. The Department of Defense uses common carrier lines for many of its emergency circuits. It also generally uses some form of radio backup circuits on its really critical circuits. This then is probably the answer, i.e., that regardless of whether common carrier circuits or private microwave circuits are in themselves more reliable and survivable, the fact that both are available for use gives a much greater reliability than would either facility alone.

If minimum cost is really the most important consideration then the proper move is to answer yes to the question and proceed to the box on the left.

Here it is found that cost considerations limit the possible choices to the first three plans (Figure 5-1). These are the three lowest priced plans. Ironically, cost alone cannot even be used to decide among these three because their cost differences lie within the expected limits of accuracy of the estimating data. The decision maker then proceeds to Discussion A on Page 198 which presents some of the advantages and disadvantages of each of the three alternatives. These alternatives are subjective in nature and no clear cut guide lines exist for making a final choice. This is not a critical choice, however, as any of the three systems would be a satisfactory choice and would be more economical than any of the last four plans shown in Figure 5-1.

If the answer to the first question had been that cost was not the most important consideration then the proper move is to answer no to the question and proceed to the box on the right. Here a second question is presented: *Are the Police, Highways and Civil Defense priority circuits requirement for high reliability and survivabilty worth a cost premium of 20 percent, ($354,700 per annum) in the cost of the distribution network?*

If the answer is yes, proceed to the next box where it is found that cost now can be used as a reliable means of making a choice. The three lowest cost plans are excluded from consideration because they lack the necessary circuit redundancy required for the priority circuits.

Plan 4 is the obvious best choice, though it should be pointed out that Plans 4 and 5 differ in cost by less than two percent and Plan 5 could easily become lower in cost than Plan 4 due to a changed competitive climate and other considerations at the time of actual procurement. This and some other factors that could influence the choice are presented in Discussion B on page 202.

Discussion A

Choice of alternative plans has been limited to the three lowest cost alternatives of Figure 5-1. Differences in cost among the three alternatives are too small to allow a choice to be made on the basis of cost ($29,000 per year between the highest and the lowest cost systems). This represents less than two percent difference in the total system costs or 3.5 percent difference based on the ETV network costs alone. This quantity is considered to be smaller than the uncertainty in the costing data itself. For example, the common carrier costs could be changed through the approval of new tariffs by the Illinois Commerce Commission. Also, procurement costs of the State owned or State leased systems could vary up or down somewhat from the estimated costs as a result of the competitive climate that prevails when the procurement is initiated. In the State owned system, maintenance experience may vary somewhat from the estimate used.*

Other criteria must be considered in the choice of ETV system to be implemented.** Unfortunately, most of the criteria tend to be more subjective than objective and do not readily lend themselve to quantification or weighting in a way that allows straight forward comparisons to be made. For example, one plan may be more flexible than the others in allowing major changes to be made in the system after implementation is complete. *What is this increased flexibility worth in dollars compared to other systems?* We can not say as we do not know how likely it will be that major changes will be desired after 1975.

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[*] The contract between the State of Nebraska and the Nebraska Consolidated Communications Corp. provides for additional payment by the State if the cost of maintenance increases more than some nominal factor during the contract period, so even the leased system may have a built-in cost uncertainty.

[**] The Administrative network costs are the same for all alternative plans so do not enter directly into the decision making process at this point.

Or, we may ask: *what quantity can be assigned to funding flexibility in one system so that it may be compared to reconfiguration flexibility in another system?* Again we cannot say because we are trying to compare two dissimiliar quantities. Recourse must be had to subjective judgement in making the selection from among alternative systems where costs are too similiar to provide a criterion of choice. Some of these considerations are:

- Flexibility (Funding) A common carrier system is more flexible because the State is only committed to fund one year of rental costs. This means that major reconfigurations of the network as a result of operating experience could be made at a relatively low cost. (See section on Phased Implemention below.)
- Flexibility (Operational) A State owned system offers more flexibility for operational reconfiguration (not geographical). Special temporary circuits may be easily provided as long as they are within the capability of the equipment. Special circuits from a common carrier are a problem if no tariff exists for the service.
- System Growth. While the basic requirement for the ETV system was to inter-connect 15 broadcast transmitter sites with six studio locations, there was also the implied requirement that closed circuit TV systems in all school districts in the State would be able to interconnect with the network. In the State-owned and State-leased alternatives this has has been arranged for as all of the microwave repeaters are of the demodulate-modulate type especially chosen to make the video signal available at all of the repeaters in the network.

Of course, there will be additional costs associated with sending the video signals from the repeater station to the input points of the closed circuit systems. In the common carrier system each additional input or output point that is added to the network will be costed on the airline mileage between the closed circuit system (e.g. a school) and the nearest circuit point where the signal is available. The additional costs for future additions to the system cannot be estimated until the number and location of future interconnecting closed circuit systems can be specified. As was pointed out, no long-range planning in this respect has been done.

- Uncertainty in Future Costs Over the 15 year life of the ETV network the cost can only be known with reasonable certainty if the system is State-owned or leased, as the contracted costs would have been agreed upon in advance. With the common carriers, requests for tariff changes are almost a continuous activity. If the tariffs should be raised during the 15-year period assumed for the system life, then the estimates that have been used for the common carrier network are too low. It cannot be accurately forecast how any particular tariff will change with time, however, as past history has shown that some tariffs have gone up while others have gone down.

- Sensitivity to Financial Climate Ownership by the State has the advantage that, though relatively inflexible, it is permanent and any fluctuations in State financing can have little effect on a system to which the State has been financially committed in advance. From some points of view, this is not necessarily a benefit.

- Advantages of Leasing A leased system with option-to-buy in some ways combines the good features of both the common carrier and the State owned systems. The State is not committed to raising the full purchase price of the system in the first years of operation but pays for the service in monthly or annual installments as in the common carrier system, yet it has more direct control over the design of the system.

- Pride of Ownership and Employee Morale A subtle but real benefit in a State owned system is the feeling of pride engendered in State employees with the proprietorship of a State owned and maintained system. It is a positive factor of employee morale as was observed among operating and maintenance personnel of the Illinois Toll Highway Commission relative to their microwave network. On the other hand, a leased or common carrier system relieves State personnel of many administrative problems and hidden costs that go with proprietorship and maintenance of a large electronic system.

Discussion B

While Plan 4 is the obvious choice based on cost, it should be pointed out that, at the actual time of procurement, conditions may have changed so that Plan 5 would be the least expensive. Plan 4 costs are based on a fixed percentage per annum of the initial cost of the system. In this case, 22 percent was used (the figure used in Nebraska for their first phase microwave network). If negotiations with Illinois should result in an increase of only one percent (to 23 percent) it will make the State owned system costs less than the leased system costs.

Plans seven and eight are definitely out of consideration as too costly.

The choice reduces to Plan 4 or Plan 5. While cost alone can be used to make the decision, there are some differences in the two plans that should be considered. The difference in cost between the two plans is not really so great (less than two percent) that it need be the determining factor if other criteria are also important to the decision maker.

At least the following considerations should be weighed before a final decision is made.

- Considerations of a State-Owned System

  1. It requires immediate payment of a large sum of money or adding to the debt burden of the State.
  2. A maintenance organization must be formed and personnel must be hired and administered.
  3. More flexibility in setting up special circuits can be realized because of the more complete control of the system and the greater familiarity with the details of the system on the part of personnel.

- Considerations of a Leased Systems

    1. A leased system requires commitment to an annual payment for services without initial capital investment.
    2. The State is relieved from the responsibilities of maintaining spare parts inventories, test equipment, hiring and training maintenance personnel and the other chores that go with ownership of a large system.

TOTAL SYSTEM COSTS

The costs developed in this part of the Report were for the purpose of making cost effectiveness studies so only those costs that varied among alternative plans were considered. There are other costs, however, that are a significant part of the total telecommunications package for 1975 and it is misleading to concentrate exclusively on the comparative costs. For this reason Table 5-1 has been prepared to show the total estimated costs of the ETV and and Administrative networks shown in Figure 5-1 plus the much larger costs due to implementation of the 11 UHF ETV broadcast stations and the projected 1975 telephone bill for local telephone service.* This latter item, as pointed out in Part Two of this document represents about 87 percent of the total telephone bill and completely swamps the small variations in costs between the alternative plans show in Figure 5-1. UHF transmitter costs are developed in the following paragraphs and converted to annual costs to allow comparisons to be made.

UHF Station Costs

The Jansky and Bailey plan specified a total of 16 ETV broadcast stations, five of which are already installed and operating. These are WTTW (VHF) and WXXW (UHF) in Chicago, WILL (VHF) in Monticello, WSIU (VHF) in Tamaroa, and WUSI (UHF) in Olney.

Cost for the additional 11 UHF stations are summarized below. Detailed costs are based on the original costs developed by Jansky and Bailey with updating to present selling prices supplied to SDC by the General Electric Corporation. The detailed costs are shown in Appendix C.

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* Report B, p. 43.

Table 5-1

Estimated Total 1975 Annual Costs for ETV and Telephone Service for the Seven Alternative Plans

	ETV Network	ETV Broadcast Transmitters	Total ETV (1+2)	Administrative Network	Local Telephone Service	Total Telephone (4+5)	Land Mobile Radio*	Grand Total (3+6)
(1)	1	2	3	4	5	6	7	8
ETV Net (Leased) Adm Net (POTS) Annual Cost	$ 821,667	$1,685,209	$2,506,876	$ 906,880	$15,595,000	$ 16,501,880	403,333	$19,412,089
(2) ETV Net (State Owned) Adm Net (POTS) Annual Cost	829,307	1,722,946	2,552,253	906,880	15,595,000	16,501,880	403,333	19,457,466
(3) ETV Net (Common Carrier) Adm Net (POTS) Annual Cost	850,968	1,722,946	2,573,914	906,880	15,595,000	16,501,880	403,333	19,479,127
(4) ETV Net (Leased) Adm Net (Leased) Annual Cost	821,667	1,685,209	2,506,876	1,290,935	15,595,000	16,885,935	403,333	19,796,144
(5) ETV Net State (Owned) Adm Net (State Owned) Annual Cost	829,307	1,722,946	2,552,253	1,321,547	15,595,000	16,916,547	403,333	19,872,133
(6) ETV Net (Common Carrier) Adm Net (Leased) Annual Cost	850,968	1,722,946	2,573,914	1,440,067	15,595,000	17,035,067	403,333	20,012,314
(7) ETV Net (Common Carrier) Adm Net (State Owned) Annual Cost	850,968	1,722,946	2,573,914	1,476,815	15,595,000	17,071,815	403,333	20,049,062

*Maintenance on radio equipment with replacement value of $5,192,416

Carbondale (Goreville)	$ 781,740
De Kalb	643,740
Edwardsville (Carlinville)	918,640
Freeport	643,740
Kankakee	643,740
Macomb	781,740
Peoria	643,740
Quincy	643,740
Rock Island-Moline	671,740
Total Equipment and Installation	$7,660,040
15% Accessories and Spares	1,149,006
GRAND TOTAL	$8,809,046
Interest	
Cost of Money - 5%	
Amortized to Payoff in 15 years	$3,921,169
Maintenance	
10% per year for 15 years	$11,490,060
Lost Taxes	
2.5% per year for 15 years	1,623,928
TOTAL 15 YEAR LIFE COST	$25,855,203
ANNUAL COST	$ 1,722,946

Leased System Costs*

This is based on a lease rate of 22 percent per year of the firm fixed price bid for the installed cost of the system, which in the case of the 11 transmitter stations is taken to be $7,660,040.

Annual Leased Cost	$1,685,209

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[*] The Nebraska Consolidated Communications Corporation indicated that they would be willing to furnish the same lease arrangement for UHF broadcast transmitters as for a Statewide microwave network.

PHASED IMPLEMENTATION

Implementing the ETV network in two phases has been considered. One of the advantages of such phasing is that all of the costs for the complete system need not be committed at one time, making the task of financing somewhat easier. Phasing the construction work would be possible if some parts of the network are needed sooner than other parts so that a priority list for the various facilities may be established.

The two-phase plan for implementation suggested by Jansky and Bailey is the phasing proposed in this study. It is based on supplying network channels to those University campuses that are presently actively engaged in ETV operations and to those ETV broadcast stations that are presently operational.

This phasing scheme only applies to the ETV network and cannot be undertaken where there is a combined ETV and administrative network because the routing priorities of ETV operations are incompatible with those of the Administrative network. The objective of the ETV network is to inter-connect the existing ETV transmitters with the university campuses engaged in ETV operations, whereas, the Administrative network seeks to interconnect all of the high traffic density voice and data corridors in the State and to furnish all of the priority traffic dedicated lines for the Police, Highways, Mental Health and Civil Defense operations. It would seriously jeopardize these services to try to implement them on a piece-meal basis. In this study, therefore, only the first three plans in Figure 5-1 are costed in two phases. This costing is done for the purpose of investigating the level of savings that may be made by such phasing. It could offer an additional criterion for selection of one plan over the others, provided the choice is narrowed to one of the first three plans shown on Figure 5-1 (the left hand path of the decision model in Figure 5-2).

The parts of the State owned network shown in Figure 4-5 that correspond to the Phase I network in the Jansky and Bailey report are costed as Phase I for this study.

It is an open-ended network consisting of a single two-way channel connecting the campuses at Chicago, Urbana and Carbondale with a spur up through Edwardsville and Carlinville. An extra one-way channel also connects Urbana to Chicago and Carbondale to Edwardsville for closed circuit use.

Table 5-2 shows the detailed costing for a Phase I common carrier ETV network. Tables 5-3 and 5-4 develop annual costs for a Phase I State-owned and a leased system. The costing follows the procedures used for the costing of the individual subsystems in Part Four of this document.

Figure 5-3 is a bar-chart comparing the three lowest cost alternative plans (Plans 1 through 3 in Figure 5-1) with the Phase I costs superimposed. For clarity, only POTS with a P-1 grade-of-service is used because the same relative rankings would not change if P-10 grade of service were substituted.

It can be seen from Figure 5-3 that the relative cost ranking of the three alternatives is different for the Phase I implementation than for the full Phase I and Phase II implementation, though the difference between the highest and lowest cost plans is again small ($33,000 per annum). This does not make a good selection criterion as full system costs are most important in the long run.

While the Phased deployment does not help in choosing one alternative plan over another, it does offer some potential savings to the State. By operating a network that connects only the existing ETV broadcast stations the State will spend between $500,000 and $600,000 less per annum in network costs depending on the option chosen. Savings in the neighborhood of $1,700,000 would also be possible by not implementing the 11 UHF stations. Altogether then about $2,300,000 less per annum would be spent during the period that Phase I is operating and Phase II is not implemented.

By far the largest savings come about from not implementing the 11 additional ETV broadcast stations. It would seem to be false economy, therefore to build the 11 ETV stations and not interconnect them with an adequate network so the logical course of action would be to implement the two systems together.

Table 5-2

ETV Common Carrier Network Phase I Costs

CHANNEL MILES	NO. OF CHAN-NELS	TRANSMITTER LOCATIONS	DISTANCE AIRLINE MILES	CHANNEL 1 AT $31.50 PER MILE	CHANNEL 2 AT $14.00 PER MILE	CHANNEL 3 AT $14.00 PER MILE	TOTAL COST PER MONTH
144	3	Chicago - Kankakee	48	$1,512	$ 672	$ 672	$ 1,856
216	3	Kankakee - Urbana	72	2,268	1,008	1,008	4,284
72	2	Urbana - Monticello	24	756	336		1,092
138	2	Monticello - Charleston	46	1,449	644		2,093
132	2	Charleston - Olney	44	1,386	616		2,002
228	2	Olney - Tamaroa	76	2,394	1,064		3,458
78	3	Tamaroa - Carbondale	26	819	364	364	1,547
186	3	Tamaroa - Edwardsville	62	1,953	868	868	3,689
78	2	Edwardsville - Carlinville	26	819	364		1,183
1272		TOTAL					$ 21,204
		ANNUAL COST					$254,448

Table 5-3

ETV State-Owned 12 GHz Microwave Network
Phase I Site Locations and Costs

LOCATION	LAND, TOWER, BLDG.	ANTENNAS @ $2,000	MICROWAVE RADIO EQUIPMENT	TOTAL
Ashkum	$23,500	$4,000	$22,200	$49,700
Buckley	23,500	4,000	22,200	49,700
Carbondale	23,500	2,000	15,500	41,000
Carlinville	23,500	2,000	10,500	36,000
Champaign	23,500	4,000	19,450	46,950
Charleston	23,500	4,000	14,450	41,950
Chicago	23,500	2,000	16,000	41,500
Clay City	23,500	4,000	14,450	41,950
Dorchester	23,500	4,000	14,450	41,950
Du Quoin	23,500	4,000	22,200	49,700
Edwardsville	23,500	4,000	19,950	47,450
Greenup	23,500	4,000	14,450	41,950
Joliet	23,500	4,000	22,200	49,700
Kankakee	23,500	4,000	22,200	49,700
Monticello	23,500	4,000	14,450	41,950
Mt. Vernon	23,500	4,000	14,450	41,950
Nashville	23,500	4,000	22,200	49,700
Newton	23,500	4,000	14,450	41,950
Olney	23,500	4,000	14,450	41,950
Orchardville	23,500	4,000	14,450	41,950
Rantoul	23,500	4,000	22,200	49,700
Tamaroa	23,500	6,000	35,450	64,950
Trenton	23,500	4,000	22,200	49,700
Tuscola	23,500	4,000	14,450	41,950
Willow Springs	23,500	4,000	22,200	49,700
Wilton Center	23,500	4,000	22,200	49,700
TOTAL				$1,194,350

Table 5-4

Cost Summary for Phase I ETV Network (12 GHz System)

Equipment and Installation	$1,194,350
15% Accessories and Spares Chicago and Carbondale	12,375
5% Accessories and Spares Balance of Stations	166,778
GRAND TOTAL	$1,373,503
INTEREST 5%	
Cost of Money - 5% for 15 years Amortized to Pay Off in 15 years	611,387
MAINTENANCE	
10% per Year for 15 years	2,060,255
LOST TAXES	
2.5% per Year for 15 years	253,202
TOTAL 15 YEAR LIFE	$4,298,347
ANNUAL COST	$ 286,556

Leased cost at 22 percent of initial equipment and installation cost ($1,194,350)=$262,757

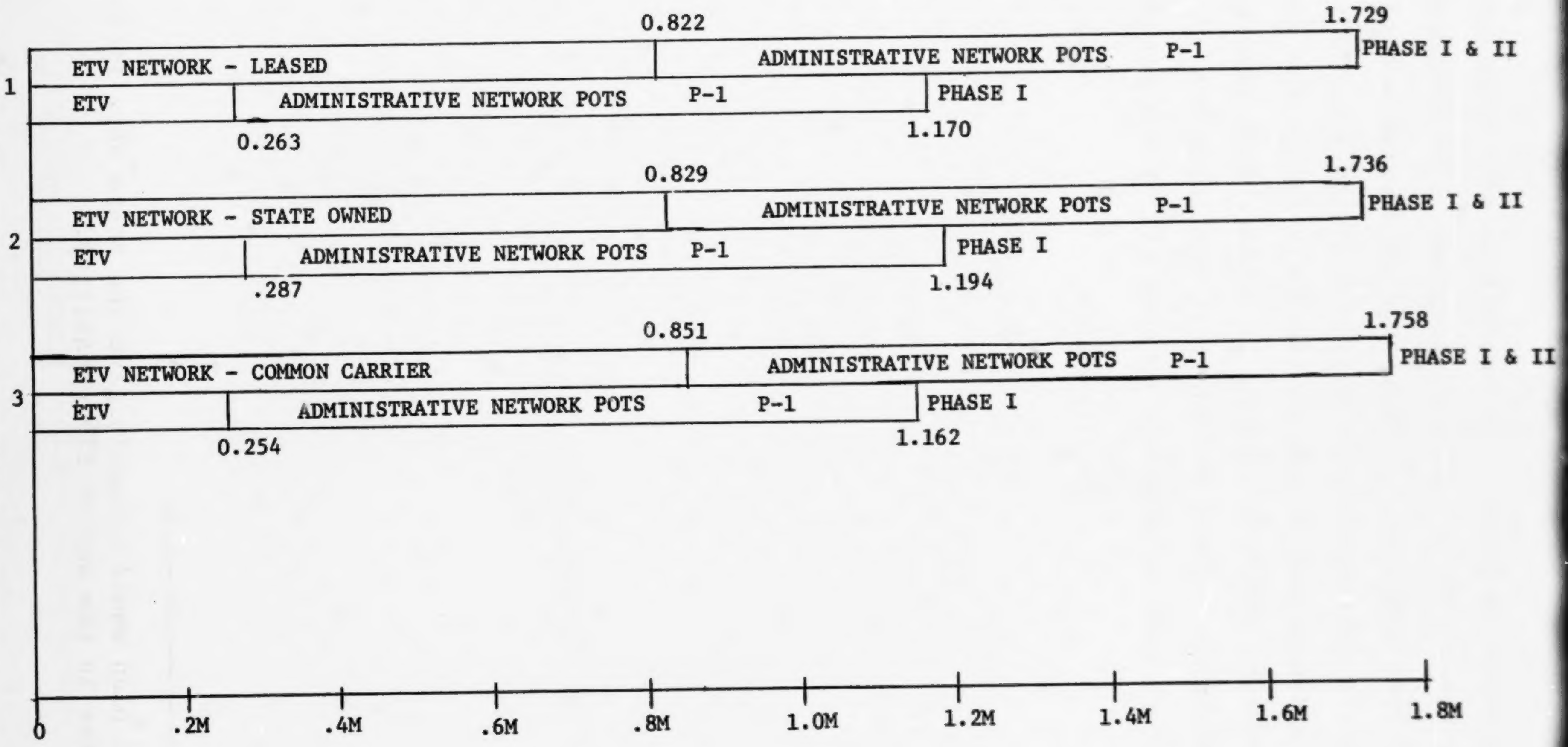

Figure 5-3

Cost Comparisons of Three Lowest Cost Systems
with Phased Implementation

Though saving money, a Phase I implementation plan does not give the State the coverage that the ultimate system would give.[*] The broadcast coverage is only a fraction of that required. Interchange of program materials throughout the State is severely limited and the desire to bring all educational elements of the State closer together is not realizable. Except for short periods of time due to construction schedule delays, it appears that phasing of implementation would be undesirable. Where the money is available the complete system should be implemented as soon as possible so that all of the potential users can be served.

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[*] The Phase I plan would actually give the State very little more than they now have in the way of ETV capability.

POTENTIAL SOURCES OF FEDERAL FUNDS

A factor which complicates any projected costing for a telecommunications system is the possibility that--if it is built in some certain way or called by some certain name--the Federal government will pay a large part of the costs. If true, the State would certainly take the Federal funds into consideration in making its plans. This possibility was carefully investigated for Illinois and, although many programs in the states are eligible for matching funds for telecommunications, the total applicable and available to this system is probably not enough to influence a choice of approach or financing method.

Potentially, four departments and agencies provide Federal funds that could be used to support the implementation of a major telecommunications system in the State of Illinois. These are:

1. Department of Transportation
2. Department of Justice, Office of Law Enforcement Assistance
3. Office of Civil Defense
4. Department of Health, Education, and Welfare

Each of these is discussed below in relation to the specific funding requirements of the State of Illinois.

Department of Transportation

The Department of Transportation manages one program that is likely to have a direct bearing upon the development of a telecommunications system for the State of Illinois. This is the Highway Safety Bureau of the Federal Highway Administration.*

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*Highway Safety Act of 1966, Public Law 89-564.

The Highway Safety Program provides Federal grants to assist the states and their political subdivisions in developing highway safety programs to meet the Federal safety standards prescribed by the Department. There are 13 such standards. Of these eight may involve telecommunications, often in association with electronic data processing:

Motor Vehicle Registration
Driver Licensing
Traffic Courts
Identification and Surveillance of Accident Locations
Traffic Records
Emergency Medical Services
Highway Design, Construction, and Maintenance
Traffic Control Systems

The standards for traffic records specifically mention electronic data processing, and the standard for emergency medical services specifically mention telecommunications. The other six standards do not specifically mention either; they have the potential, however, of involving telecommunications, including telecommunications required to support electronic data processing systems.

Within any of the areas covered by a standard, a state may obtain 100 percent funding for an experimental or developmental project involving advanced applications of telecommunications and data processing. The first state grant was made in April, 1967. As of 7 June 1968, however, no equipment grants had been made to the State of Illinois. Several grants have been made to nearby states, an indication of the wide range of possibilities open to Illinois.

The State of Nebraska received a grant of $315,000, providing total funding of a project for re-evaluating and improving methods of providing medical assistance to the victims of highway accidents. This project will not, in itself, procure telecommunications for Nebraska, but, rather, will allow the State to develop new methods of using the first increments of what will be a new Statewide telecommunications system.*

In contrast, two grants have been made to the State of Ohio, both of which contribute directly to the procurement of telecommunications capabilities. In one of these the Federal government is supplying $133,000 to establish a teletypewriter communications network between various police and sheriff stations throughout the State and a computerized traffic records system maintained by the State. In the second grant, the Federal government furnished $617,000 as partial funding for the Ohio Law Enforcement Automated Data System (LEADS), which will cost more than $2 million and which involves extensive telecommunications.

The Ohio LEADS is indicative the flexibility that exists in the Highway Safety Program. It is a general-purpose law enforcement information system, one component of which relates to highway safety under the traffic records safety standard. Through negotiations with the Department of Transportation, the State of Ohio was able to secure support for that portion of Ohio LEADS that corresponds with the mission of the National Highway Safety Bureau. Clearly, the circumstances in Illinois differ, since Ohio was not developing a general-purpose, Statewide telecommunications network. However, it may be possible to obtain support for part of the Illinois network by identifying that percentage of the overall system that carries information in support of a function (especially traffic records) that corresponds with one or more of the highway safety standards.

In addition to the Highway Safety Program, two other programs administered by the department of Transportation are of potential interest to the State of Illinois:

Emergency Highway Call Systems
Traffic Control Systems

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*This system is being procured with the assistance of the Office of Civil Defense. See Office of Civil Defense section.

Both programs are administered by the Bureau of Public Roads, Federal Highway Administration.* (There is some overlap between the Bureau of Public Roads and the National Highway Safety Bureau in the area of traffic control; the two programs proceed separately, but more or less in parallel.)

Highway emergency call systems are being funded under the Federal Highway Construction Program. (The program provides 90 percent Federal funding for the Interstate Highway Program, 50 percent for the other Federal highways.) System installation has been authorized for the purpose of obtaining operating experience; the equipment itself need not be innovative, but the system to be installed must be found by the Bureau to be unique with respect to some operational condition. The Bureau will approve a system only if it believes that operational experience will be gained which cannot be obtained from an existing system. The system, usually comprising call boxes spaced about one-half mile apart on each side of a highway, may be either wire line or radio, voice or signal. (The latter is not favored.) Peat, Marwick, Livingston and Company, San Francisco, California, did a feasibility study and equipment specification for the Division of Highways on an emergency call system for Interstate Highway 80 between Chicago and Moline. This study which was due in September, 1968, was 90 percent Federal and 10 percent State financed under the Interstate Highway Program. This program specifies that some small percent of highway funds will be spent on R and D projects, but the telecommunications applications, while allowable, will probably be so specified, as in the cited case, that the State will be unable to use this type of funding in its general telecommunications projects.

Traffic control systems are being investigated through research and development funds.** The Bureau still considers this program to be in the early research and development stage, and it has only funded three experimental systems throughout the country. One of these is on a six-mile stretch of the Eisenhower Expressway near downtown Chicago. This installation was funded by Federal, State, county, and local funds.

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*23 USC 307.

**Highway Safety Act of 1966, Public Law 89-564.

Neither emergency highway call systems nor traffic control systems appear among the telecommunications requirements of the State of Illinois. However, it appears likely that both types of systems (especially the former) will be well out of the research and development stages before 1975. Therefore, both types of systems should be noted as potentially contributing funds and traffic to any Statewide telecommunications network.

Department of Justice, Law Enforcement and Assistance Administration

The Omnibus Crime Control and Safe Streets Act of 1968, Public Law 91-351, established the Law Enforcement Assistance Administration within the Department of Justice. The purpose of the Act is to:

1. "Help State and units of general local government to prepare and adopt comprehensive plans, based upon their evaluation of State and local problems of law enforcement;

2. "Authorize grants to State and units of local government in order to improve and strengthen law enforcement; and

3. "Encourage research and development directed toward the improvement of law enforcement and the development of new methods for the prevention and reduction of crime and the detection and apprehension of criminals."*

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*Public Law 91-351, Declaration and Purpose.

The Act provides for grants to the States for the establishment and operation of State Law Enforcement Planning Agencies for the preparation, development, and revision of the State plans. These grants cannot exceed 90 percent of the expenses of establishing and operating the agency. At least 40 percent of the granted Federal funds must be available to units of local government. For the purpose of developing this agency, each State receives a minimum of $100,000, with additional amounts allocated according to population. In Fiscal Year 1969, Illinois has been allocated $881,650 for this purpose. Funding for future years is discussed below.

Grants to states are also authorized for law enforcement purposes, applicable to:

> "...the development, demonstration, evaluation, implementation, and purchase of devices, facilities, and equipment designed to improve and strengthen law enforcement and reduce crime in public places....
>
> "Construction of buildings or other physical facilities which would fulfill or implement [this purpose]....
>
> "the development of systems for collecting, storing, and disseminating information relating to organized crime...."*

The grants for the devices, facilities, and equipment may be up 60 percent of the cost of that program, up to 50 percent for construction, and up to 75 percent for systems. At least 75 percent of the grant funds must be available to units of local government or combinations of such units. The state shall show that "Federal funds--will be so used as not to supplant state or local funds, but to increase the amounts of such funds that would, in the absence of such Federal funds, remain available for law enforcement.[*] The state should also show that it, and the participating local government, are willing to assume the cost of improvements needed--after a reasonable period of Federal assistance."[**] In Fiscal Year 1969, Illinois has been allocated $1.34 million for implementation projects.

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*Ibid., Section 301 (b).

The Act establishes a National Institute of Law Enforcement and Criminal Justice, authorized "to make grants to...public agencies, institutions of higher learning, and private organizations to conduct research, demonstrations, and special projects...including the development of new or improved approaches, techniques, systems, equipment, or devices..."[***] The grant may be up to 100 percent of the project costs. No grants have yet been made under this part of the program.

The Law Enforcement Assistance Administration can be regarded as a potential source of funds for the implementation of a Statewide telecommunications network in Illinois. Since the program is so new, there are no formal guidelines for grants, and no grants will be made until late in Fiscal Year 1969. Emphasis will be upon block grants to the states, with relatively loose Federal control over expenditure of the funds. However, it appears impossible for the State to commit all or even a major part of any year's implementation funds to the procurement of a general purpose, Statewide telecommunications system. Three constraints prevail: (1) the system must be a law enforcement system at least by broad definition, (2) the State must undertake projects in a number of very broad areas such as reduction of organized crime, control of riots, improvement of courts, education of the general public and of law enforcement professionals, etc., and (3) the State must supply at least 75 percent of available funds to local governments to support their programs.

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[*] Ibid., Section 303 (10.

[**] Ibid., Section 303 (8).

[***] Ibid., Section 402 (b) (1).

The first constraint can probably be resolved by applying a portion of available funds to that percentage of the network that serves law enforcement functions. There is no precedent for this prorated application of funds, however, and any such proration will have to be negotiated with the Law Enforcement Assistance Administration.

The second and third constraints simply limit the amount of funds that can be applied to a Statewide telecommunications network in any one year. The problem is somewhat complicated by the requirement to purchase all equipment obtained under the program. To make full use of funds available under the Omnibus Crime Control Act, as it is currently structured, it may be necessary for the State of Illinois to own the network and to implement it in modular fashion over a period of years.

In Fiscal Year 1969, the Omnibus Crime Control Act authorized slightly more than $100 million, but only $63 million was actually appropriated. The same amount is authorized for Fiscal Year 1970, and $300 million is authorized for Fiscal Year 1971, and after. It is possible to predict that the appropriation level will probably increase, but it is impossible to predict the levels of funding in Fiscal Year 1970 and beyond. Therefore, it is not possible to develop specifics as to possible funding available to Illinois for implementing its telecommunications network.

Office of Civil Defense

The Office of Civil Defense (OCD) administers two programs that are applicable to the development of a Statewide telecommunications system:

Personnel and Administrative (P&A) Contributions Program
Supplies, Equipment, and Training (SE&T) Contributions Program

The P&A Contributions Program[*] allows OCD to provide financial support to states, and, through them, to their political subdivisions for 50 percent of the cost of essential state and local civil defense personnel and administrative expenses. Considerable emphasis is placed upon upgrading the quality of state and local civil defense agencies.

P&A funds can be used to procure telecommunications equipment and services necessary for day-to-day civil defense administrative traffic from the civil defense agency to full time staff members. However, the most important telecommunications application of P&A funds is supporting 50 percent of the salary of full and part-time civil defense telecommunications planning and management personnel. These personnel need not be in the state civil defense agency, but their civil defense functions and their relations to the state civil defense agency must be defined in the approved state civil defense administrative plan which the state has on file with the Office of Civil Defense.

Despite the fact that P&A funds have increased every year since the inception the program, the State of Illinois does not appear to have made as extensive use of P&A funds for telecommunications management as have several of the other large states. In Fiscal Year 1968, for example, California used approximately $100,000 and New York used approximately $65,000 of their P&A funds for state telecommunications management personnel, while Illinois used only about $16,000 of its P&A funds for this purpose. When the proposed telecommunications management capability for the State is created, it may be possible, by amendment of the State civil defense administrative plan, and upon acceptance of this amendment by the Regional Director of the Office of Civil Defense, to increase P&A funds available to support telecommunications management in the State of Illinois. However, any such increase must be directly related to an increase in civil defense capabilities.

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[*] Public Law 85-606, 72 Stat. 532, as amended.

The SE&T program* will provide up to 50 percent of state and local expenses involved in obtaining materials, facilities, organizational equipment, services, and training required for civil defense purposes. Equipment procured with the aid of contributions made under the SE&T Contributions Program--with the significant exception of telecommunications equipment--must be used solely for civil defense purposes. However, because of the close relationship of activities required to prepare for enemy-caused and other-than-enemy-caused disaster, civil defense equipment obtained with the assistance of SE&T contributions may be used in preparation for, and during, other-than-enemy-caused disasters--including local natural disasters and major disasters. In contrast, telecommunications equipment procured with Federal assistance under the SE&T Contributions Program can be used for the transmission of non-civil defense traffic on a routine, day-to-day basis. This day-to-day use of telecommunications equipment must not (1) involve removing the equipment from the place in which it is used for civil defense purposes, and (2) jeopardize its immediate availability for civil defense purposes. However, when telecommunications equipment procured with the assistance of SE&T funds is used for day-to-day traffic, OCD will not provide financial assistince for ongoing maintenance and supporting costs, as they will for equipment used exclusively for civil defense purposes.

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*Federal Civil Defense Act of 1950, Public Law 81-920, 64 Stat. 1249-1251, as amended.

OCD does not discourage leasing of civil defense equipment including telecommunications. However, its guidance recognizes that the OCD budget is subject to annual Congressional action. OCD, therefore, limits its contributions for lease costs to the fiscal year for which the contribution is approved. OCD guidance states, furthermore, that a contribution for leasing costs in one fiscal year cannot be considered a precedent for contributions for similar costs in subsequent fiscal years.

In order to establish eligibility for contributions to support the procurement of telecommunications equipment, a telecommunications planning report must be prepared and submitted to OCD. The Director of the appropriate OCD Region must review the telecommunications planning report and determine whether it is acceptable to OCD. Approval of the telecommunications planning report by OCD is not a commitment by OCD to provide matching funds for equipment and services. The approved planning report merely identifies items for which a State or one of its subdivisions can then request financial assistance.

There are, however, several criteria that a state must meet to qualify for telecommunications matching funds. Fixed equipment must be located so that operating personnel are protected against the effects of radioactive fallout except where the equipment will be used solely for the receipt and dissemination of warning. Minimum protection criteria for all locations except public shelters is a Protection Factor (PF) of 100, i.e., an attenuation of radiation inside the shelter to 1/100th its intensity outside the shelter. Telecommunications solely for interconnecting public shelters must be located in space providing at least 40 PF. Furthermore, any fixed telecommunications equipment procured with OCD matching funds, except that for public shelters, fixed radiological defense monitoring stations, and locations designated for receiving and disseminating warning information, must include on-site emergency power, with a connected 14-day fuel supply. Emergency generators in unmanned base stations and repeater stations must be equipped to detect power failures, to start the generators, and to switch the telecommunications equipment over to emergency power.

OCD will not contribute SE&T funds to buy a new system unless a complete system study demonstrates to OCD's satisfaction that such a new system is the only way to perform the required function. If an area needs a telecommunications system for direction and control, that system cannot be redundant with existing systems such as those operated by the police and fire services.

OCD will not furnish financial assistance where the telecommunications equipment (generally mobile equipment) is to be used between a control point and its own or any other subordinate units except where the telecommunications provided form the principal direction and control network for the executive head of the State or for the executive head of a political subdivision. Where a single service (e.g., police, fire) provides the principal direction and control network for a jurisdiction, OCD may approve requests for mobile telecommunications equipment for the head of each other service with an emergency function.

In recent years, the funds available to the Office of Civil Defense have, with one minor exception, been lower in each successive year. In Fiscal Year 1962, the Office received an appropriation of $207.6 million; in the current fiscal year its appropriation was only $61 million. While future years may see an increase in the funds available to the Office of Civil Defense, the probability is high that its funding level will, short of a major and protracted international crises, remain well below $100 million. In addition to its increasingly restricted funding, the Office of Civil Defense has become very concerned with minimizing the tendency to build separate telecommunications systems for essentially parallel functions such as civil defense, police, fire, highways, etc. Along these lines it has developed the rules, cited above, for the justification of new civil defense systems.

The Office of Civil Defense is a possible source of support for the implementation of a Statewide telecommunications network for the State of Illinois. Although any application for SE&T funds to be used for this purpose will have to be reviewed on the basis of an individual application and in relation to the funds available in the fiscal year that the application is received, it can be stated that, despite its approval of the concept of a general-purpose statewide network, the Office of Civil Defense probably cannot fund 50 percent of the cost of such a network. There is, in fact, a recent example of such a refusal. The State of Nebraska applied informally for matching funds for a Statewide network that it is procuring and it was turned down. As a comparison, however, the Office of Civil Defense did match funds (for one year only) for the first increment of that system. The one-year funding is designed to allow the State civil defense agency, which developed the network, time to obtain users and funding from other Nebraska agencies. The first increment of the Nebraska system is being leased as a system from a vendor (rather than as a service from a common carrier) so that this one-year limitation is relatively easy to effect. Future increments may be funded for one year only if the appropriation available to the Office of Civil Defense allows it, if the use of the original increment by other Nebraska agencies increases to make that increment self-sustaining, and, finally, if there are special circumstances that require time for the various Nebraska agencies to put their traffic onto the new increments of the system.

There is no necessary precedent in Nebraska's experience, but the State of Illinois could possibly justify a similar approach if it were to implement the planned network in increments. Thus the State may be able to get support for one year for a link between Springfield and Chicago. Clearly this is easier if the system is leased from a common carrier or from a vendor (as was Nebraska's system), but is is possible that some funding arrangement could be negotiated with the Office of Civil Defense for the equivalent of one-year support in purchasing one link of a State-owned system.

Some other possible support options also exist. The Office of Civil Defense would probably consider providing 50 percent of those parts of the system added to accommodate civil defense and emergency functions. Thus any links to Mutual Aid Area Emergency Operating Centers would potentially qualify for SE&T matching funds. Similarly, any microwave repeaters added to a State-owned voice, data, and video network to accommodate emergency functions (there are four that fit this description) may qualify for such support.

Again because of the limiting factor of the annual budget it is not possible to predict the amount of funds that the Office of Civil Defense will furnish to support a system in Illinois. It can be said, however, that some limited funding will be available.

Department of Health, Education, and Welfare

Under the Educational Television Facilities Act* as amended by the Public Broadcasting Act**, the Division of Library Services and Educational Facilities (Bureau of Adult, Vocational, and Library programs) administers grants that may assist the State of Illinois in developing a Statewide telecommunications network. These grants are for the construction of educational television and radio facilities.

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*Public Law 87-447, 76 Stat. 64.

**Public Law 90-129, 81 Stat. 365.

Under the terms of these Acts, the Secretary may grant up to 75 percent of the cost of planning, acquiring, and installing television and radio broadcasting apparatus (including towers, microwave relay equipment, boosters, translators, vocal equipment, and video recording equipment). This may include equipment which would be incidentally used for transmitting closed circuit television programs. Land acquisition and building construction are not eligible for grants. The Secretary may not make grants in excess of 8.5 percent of the total appropriation for any fiscal year in any single State.

In considering television grants, the Secretary is enjoined by the legislation to consider the need for (1) prompt and effective use of all educational television channels remaining available, (2) equitable geographical distribution of educational broadcasting facilities throughout the states, and (3) provision of educational broadcasting facilities which will serve the greatest number of persons in as many areas as possible, and which are adaptable to the broadest educational uses.

Construction grants are made directly to the successful applicant. Those who may receive grants for construction of facilities include agencies responsible for the supervision of public elementary, secondary, and higher education within a state and its political subdivisions; state educational television and radio agencies; tax supported colleges and universities, non-profit foundations, corporations, and associations organized to engage in and encourage educational television and radio broadcasting and eligible to receive an FCC license for operating educational television and radio stations. In states which have established a state educational television agency, applicants must notify that agency of its application for a Federal grant, and the Secretary must keep that agency advised of the status and disposition of the grant application.

This program has had immense effect in spurring the development of educational broadcasting. The number of educational television stations more than doubled during the four years that Public Law 87-447 was in effect. In the State of Illinois alone three grants were made in Fiscal Years 1964, 1965, and 1966 for a total of approximately $1 million. Most of this money was spent on station development or improvement, since, at the time these grants were made, no more than 15 percent of a grant could be spent on interconnections. The current slowdown in Federal spending for domestic programs has, however, severely curtailed the new program established by Public Law 90-129. No appropriation was available in Fiscal Year 1968, despite an authorization of $10.5 million. In Fiscal Year 1969, $12.5 million was authorized, but only $4.4 million was appropriated ($4 million is available for grants). Illinois already has an outstanding application for over $750,000, but cannot receive more than $340,000 in Fiscal Year 1969 under the 8.5 percent limitation.

The broader scope inherent in the Public Broadcasting Act, particularly with respect to interconnections, means that the impact on telecommunications will be even greater in the future. The optional status in the legislation of a state television coordinating agency does not provide any incentive to centralize management of a state's educational broadcasting facilities. However, the Office of Education personnel who administer the program appear to favor those states that are working toward an overall plan.

Funds to support the development of an Illinois microwave network to interconnect educational television facilities may be available under the Public Broadcasting Act. This availability may depend upon the close planning for, and continued coordination of, educational television resources in the State. The funds available from this source are likely to be limited in the forseeable future. The Act authorizes $15 million in Fiscal Year 1970. Even if the entire amount were appropriated, which is unlikely, only about $12 million would be available for grants, and the maximum grant to any state, under the

8.5 percent limitation, would be about $1 million. The program expires at the end of Fiscal Year 1970, and, while it is likely to continue in some form, it is not possible to predict its future form or scope at this time.

Under the Higher Education Act of 1965,* the Division of College Facilities (Bureau of Higher Education) administers the program of instructional equipment for higher education, which includes the acquisition of closed circuit, direct instruction television equipment, materials, and associated minor remodeling. Equipment used in the Instructional Television Fixed Service (ITFS) is also eligible for grants.

The program provides two categories of assistance as set forth in the legislation. Category I covers assistance in acquiring instructional materials. Category II assistance covers the costs associated with acquiring closed circuit television equipment used for direct instruction, including ITFS, but excluding broadcast television, the costs of materials used in such instructional programs (including studio equipment), and the costs of minor remodeling associated with such acquisition.

Applicants submit requests to the appropriate state educational agency, which must be designated or created by the state for it to participate in the program. This agency prioritizes requests according to "objective standards" and submits the overall state list to the U.S. Office of Education. States are allocated their share of the total program funds on the basis of (1) the number of full time students in institutions of higher education and (2) the per capita income in the state. Normally the Federal grant covers 50 percent of the associated costs, but it may cover as much as 80 percent of the associated costs if the institution proves to the state agency that it has insufficient resources to participate in the program and is unable to acquire such resources. Eligible costs must be incurred by the grantee within a year after the grant is made. Costs associated with lease or lease-purchase arrangements are also limited to those incurred and made within the 12-month period following the grant, thereby limiting leasing arrangements to one year.

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*Public Law 89-329, 79 Stat. 1219, amended by Public Law 89-752, 80 Stat. 1241-1244.

Non-profit institutions of higher education that meet the basic maintenance-of-fiscal-effort requirement set forth in the legislation are eligible for grants under this program. To qualify for a grant, the institution is required to demonstrate a maintenance-of-fiscal-effort by expending from current funds for instructional and library purposes (excluding personnel costs) not less than it expended during the previous fiscal year. In making grants, the Office of Education may disapprove specific grants for reasons such as extravagance, but must abide by the state agency's decision as to the priority of projects within the state.

Category II assistance has already had an impact in the area of purchasing closed circuit television equipment, most of it for small systems. Most equipment is wire line, but several microwave systems have been purchased. Category I assistance, though broader in scope, has not yet had such an impact on telecommunications. Although the specific expenditures of Category II funds are unknown, Illinois received $69,000 for five projects in Fiscal Year 1966; $68,000 for eight projects in Fiscal Year 1967; and was allotted $66,000 in Fiscal Year 1968. (The number of projects in Fiscal Year 1968 as well as the Fiscal Year 1969 allottment are unavailable.)

The limited funds and the constant competition among the State's institutions displayed in the past are likely to continue in the future. These factors are likely to continue the practice of making a large number of small grants. (The average amount in Illinois was $14,000 in Fiscal Year 1966 and $8,500 in

Fiscal Year 1969.) This practice makes the Instructional Equipment for Higher Education Program a more appropriate source of funds for distributing a television signal on a campus than for financing the State telecommunications system.

Conclusions

There are several federal programs which can be expected to contribute some funds toward the development of a State-wide system for Illinois. But each of the administering agencies will make a committment of funds only in response to a specific application, and predicting the exact amount of a committment is impossible because of lack of precedent or because the funds available are declining.

Matching the needs of Illinois for such a system to the different goals of the various agencies involved may be a major problem in coordinating among the grant applications that must be prepared. Also, to get the most from each agency, it may be necessary to implement the system on a phased basis to carry it into several fiscal years and thereby avoid straining their budgets. But we believe that a deliberate stretch-out is not in the best interests of the State.

It is safe to say that some appreciable amount of federal matching funds will be obtained in small amounts from several agencies, but we believe that the total will not approach 50% of the system costs.

Finally, considering the probably small total of federal contribution, this factor is not significant in choosing among the alternatives presented in this report.

PART SIX: CONCLUSIONS AND RECOMMENDATIONS

The conclusions discussed in this part derive directly from the preceding parts of this document. While the conclusions are stated succinctly they are not intended as a summary, and their significance will probably only be understood by a reader who has at least scanned the first five parts of the document. To refresh the reader's memory each conclusion is followed by a reference in parentheses listing the part of the document on which the conclusion is based.

For continuity, each conclusion that lays the foundation for some action is accompanied with a specific recommendation to the State. This recommendation represents the best technical judgment of SDC and may not coincide with the opinions of various groups within State government. SDC has tried to discover and understand the varying points of view within the State and is fully conscious of the fact that, though differing points of view may each contain considerable merit, they may nevertheless be irreconcilable.

The work statement for this study required SDC to examine a number of different approaches to aid the Commission in "the development of a long range plan for the most effective and efficient telecommunication system for the State of Illinois." These different approaches were worked out in sufficient detail to furnish comparative cost figures. The final choice of system remains with the State, however, and this precluded the development of any one system to any greater level of detail than was necessary to make the cost effectiveness analysis.

The State has retained the responsibility for choosing the most attractive (not necessarily the cheapest) approach and now must make certain fundamental decisions. This is the nature of a cost effectiveness analysis. The pertinent factors and costs are presented to the decision maker by the analyst with the decision points plainly indicated. At this point the opinion of the analyst is no longer desirable because it is the decision maker's responsibility to decide which choice is in the best interest of the State, based upon the facts presented by the analyst as modified by the decision maker's own subjective opinions.

1. Conclusion - The largest telecommunications expense for the State, and therefore the largest potential target for savings, is the local telephone bill. (Part Two)

   Recommendation - An expert independent communications consulting firm should be hired to investigate the telephone system furnished to the State by the common carriers with the objective of minimizing the costs.

2. Conclusion - A telecommunications management organization is needed by the State to assure efficient operation of the rapidly growing State telecommunications system. (Part Three)

   Recommendation - A telecommunications management capability consisting of a high level advisory committee and an operating unit at the division level should be created to administer the complex telecommunications facilities of the State.

3. Conclusion - Interconnection of a State-owned telephone network (microwave) to the common carrier telephone plant will probably be allowed in the near future under FCC rules even though final disposition of the Carterfone Case has not been made by the Federal Appellate Court. (Part Four)

4. Conclusion - Assuming that the Carterfone decision will stand, it is legally, technically, and economically feasible for the State to operate a private telecommunications system to carry its ETV and State agency voice and data traffic. (Part Four)

5. Conclusion - Traffic congestion on the land mobile radio network in the high population density metropolitan areas is severe with only a temporary solution being offered in the near future by the transfer of additional spectrum space from the lower UHF television band by the FCC. (Part Four)

   Recommendation - Full advantage should be taken of the new frequency allocations in the Chicago area to upgrade the State land mobile networks. Extensive replacement of existing equipment, however, should be avoided until some of the newer systems offering a permanent solution to the crowded spectrum problem, that are being developed by the military, become generally available on the civilian market. They are not expected to be available before 1975.

6. Conclusion - Due to the wide bandwidths required for television channels, the only part of the spectrum that is feasible for a multi-channel State-owned or leased ETV network is in the 12-GHz band. (Part Four)

7. Conclusion - Cost differences among the three types of ETV networks, 1) common carrier, 2) State-owned, and 3) leased, are not significant. Some criterion other than cost must be used to decide which system to implement. (Part Five)

   Recommendation - Educational authorities in the State should re-examine and refine their long-range ETV network requirements to determine if decision criteria based on the type of network are involved. Otherwise, considerations such as reconfiguration flexibility, uncertainty in future costs and other more subjective criteria will determine the path to follow.

8. Conclusion - On the basis of cost criteria alone, the common carrier administrative network is preferred to the State-owned or leased networks which are at least 45 percent more costly for the same capability. The common carrier network alone, however, lacks the high reliability and survivability that would accrue to a State-owned or leased microwave system backed up by normal common carrier circuits. (Part Five)

   Recommendation - The State must decide if the high reliability and survivability afforded by a State-owned or leased administrative network is worth the extra cost.

9. Conclusion - If the State decides that a State-owned or leased administrative network with normal common carrier telephone service as backup is necessary to provide high reliability and survivability for the Civil Defense, State Police, and other priority uses, then some cost advantages accrue if the ETV network is also State-owned or leased. (Part Five)

   Recommendation - The best choice for the State in this case is either a State-owned or leased combined ETV and administrative network. The cost of adding multiplex and microwave equipment to an already costed microwave network is somewhat less than the cost of installing a complete microwave system including land, towers, buildings and other costs, even though this is offset somewhat by going to 12 GHz from 6 GHz in order to accommodate the wide bandwidths required for the ETV channels. The savings in the administrative network would be about $130,000 per year if the State-owned or leased combined ETV and administrative network is used. (See networks 4 and 5 versus 6 and 7 in Figure 5-1.) (Part Five)

10. Conclusion - No Federal agency can be depended upon to fund a substantial part of the costs of ETV or administrative telecommunications networks (e.g., 50 percent), although several agencies may be persuaded to provide some funding for specific parts of a network if these parts can be shown to meet their specific goals. (Part Five)

Recommendation - While the State should make a strong effort to get as much Federal assistance as is possible in development of its telecommunication networks, it should nevertheless be prepared to pay for the greater part of the cost out of State funds. The State should be especially careful that conforming to Federal rules to qualify for funds does not compromise other more important State requirements that may not be covered by the Federal rules. Finally, care must be exercised so that replanning to meet Federal rules does not run overall costs up to the point where they may exceed the matching funds available from the Federal government.

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GLOSSARY

This is a glossary of some technical terms used in this report. It should not be taken to represent official definitions, though authoritative sources were used wherever possible. In choosing among a number of definitions, the least technical and most understandable term was selected.

Administrative Network--The intercity telecommunication network that provides voice and data channels for all State agencies. It handles both normal and priority traffic.

APCO--Associated Public Safety Communications Officers, Inc.

Bandwidth--Refers to the range of frequencies determined by an upper and lower frequency limit that contains the information content of a radio or wire communication channel.

Carterfone Case--Refers to a milestone decision by the Federal Communications Commission in which the Carter Electronic Corp. had connected a radio telephone device to the common carrier telephone networks in violation of previous tariff rules. The Commission ruled in favor of the Carter Electronics Corp. in a major reversal of past policy and this has been interpreted by industry as opening the door to widespread interconnection of foreign devices and communication systems to the common carrier telephone network. The case is being appealed in the Federal courts so no final decision has been made.

Common Carrier--A government regulated company furnishing communications services to many customers, e.g., the telephone company.

CW (Continuous Wave)--An on-off keying form of transmitter modulation used in radio telegraphy. Code elements are formed by bursts of full carrier power interspersed with periods of no carrier power.

CD--Civil Defense

Channel Requirements--Refers to the number of communication channels required to handle a specified amount of traffic with a given grade of service. Generally, the higher the grade of service desired the larger the number of channels that will be required (see Grade of Service).

Centrex--An improved type of dial PBX service. It is an arrangement to serve one or more subscribers from a central switching machine located either on a subscriber's premises (Centrex CU) or on telephone company property (Centrex CO). Centrex service (CU or CO) permits outside callers to dial directly to telephones within the system without going through a PBX operator. This is called direct inward dialing (DID). In certain areas, Centrex systems also provide automatic identification of outgoing long distance or message unit calls by local telephone number.

Data Sets--Hardware used to transmit and/or receive machine-generated signals.

Data Traffic--All forms of digital, non-voice telecommunications. In Illinois the volume of data traffic is rapidly growing and is expected to equal or surpass voice traffic volume by 1975. During this period it is expected to consist principally of low speed teletype terminals communicating with central computer complexes. Data traffic can be classified as either normal or priority.

DDD (Direct Distance Dialing)--Dialing a long distance call without the assistance of an operator.

Dedicated Lines--Telephone lines leased from the telephone company at a fixed price per mile per month and used exclusively by the State.

Dial-up Trunks--Trunks that are subscriber accessed by dialing as opposed to access through an operator.

EOC (Emergency Operating Center)--A communications center, usually underground or protected, where State officials having civil defense responsibilities are concentrated to direct civil defense operations during a period of great emergency such as enemy attack or natural disaster.

ETV (Educational Television)--As used in this report includes Instructional Television (ITV) in the public schools as well as general educational television broadcasts to the public.

FCC (Federal Communications Commission)--The Federal regulatory agency that controls interstate telecommunication systems and all radio transmissions.

Frequency--Refers to the oscillation rate of the electronic signals used to carry the information content of a radio communication channel. Frequency is expressed in units of hertz, kilohertz, etc. which means cycles per second (cps), kilocycles per second (kcs) etc.

Gigahertz (GHz)--One billion hertz (see Frequency).

Grade of Service--A measure of the adequacy of communication channels to handle the volume of traffic carried by them. In this study the grade of service of dial accessed telephone lines is expressed in terms of the probability of reaching a line during the busy hour. This probability is expressed as a "P" number, e.g., if the probability that all trunks will be busy in one out of 100 attempts this is called P-1 service. If the probability of all trunks being busy is 10 out of 100 the grade of service is P-10.

IBT--Illinois Bell Telephone Company.

ITC--Illinois Telecommunications Commission created by Act of the 75th Illinois General Assembly (House Bill No. 2138, June 17, 1967).

Kilocycles per second (kcs)--See Frequency.

Land Mobile Radio--Radio communication between a base station and land mobile station or between land mobile stations. In Illinois, it is used principally by the State Police and the Highways Division in a number of individual networks operating in different geographical areas the limits of which are determined by the range limitations of the radio equipment used.

MAA (Mutual Aid Areas)--Illinois is divided into ten Mutual Aid Areas for civil defense purposes. They are the links to the local community civil defense agencies through which the State civil defense organization maintains contact.

Megahertz (MHz)--One million hertz (see Frequency).

Microwave--The band of radio frequencies between 0.225 and 100 Gigahertz. Multichannel telecommication radio networks utilize frequencies in this band.

Multiplex--Multiple simultaneous transmissions on a common channel.

NACOM-1--National Communications System 1, a Federally financed nationwide communication system for transmitting telephone and teleprinter civil defense messages. Its principal use is to provide resource and status information upward through the civil defense organization in time of emergency. In Illinois it connects the State EOC with Civil Defense Region Four Headquarters in Battle Creek, Michigan.

Normal Traffic--The everyday business traffic of the State agencies characterized by its non-urgent nature, by absence of emergency requirements and by its ability to be routed over shared facilities thus allowing maximum efficiency in the use of such facilities.

POTS--Plain Old Telephone Service refers to the type of telephone service offered under existing tariffs as opposed to unique sophisticated switching schemes that could be provided to the State under a special tariff offering. POTS configurations projected to 1975 were used by SDC since cost figures for special tariff applications were not available.

Priority Traffic--That portion of the traffic of the State Police, the Division of Highways, the Department of Mental Health and the Civil Defense Agency that is dedicated to urgent business and emergency use and requires exclusive facilities to ensure high reliability.

PBX--The term PBX (Private Branch Exchange) encompasses a wide range of telephone systems which accomplish all of the following: 1) intercommunication (switching) calls between stations on the system, without connecting those calls to public lines; 2) directing incoming calls from public lines; 3) connecting outgoing calls to public lines. The range of PBX systems extends from the simplest of manual PBX systems (where the operator of the switchboard places, receives, and switches calls) to the extremely complex Centrex PBX systems on which the caller accomplishes nearly all of the operations by dialing directly without going through a PBX operator. There are numerous other dial PBX systems with varying degrees of involvement by the PBX operator.

P-1--See Grade of Service.

P-10--See Grade of Service.

Piggybacked--Refers to method of carrying a narrow band data channel within the passband of a voice channel by use of selective bandpass filters. Voice currents are excluded from a small band of frequencies in the voice spectrum so this band may be used for the transmision of data, e.g. teleprinter signals.

RACES (Radio Amateur Civil Emergency Service)--A voluntary emergency communications network.

RADA (Random Access Discrete Address)--Radio communication system being developed by the U.S. Army.

Satellite ETV Network-- A radio network for distribution of educational television programs within the State utilizing a synchronous satellite as the primary transmission medium. State-of-the-art limitations make this network economically infeasible at this time and for the near future.

SDC--System Development Corporation, 2500 Colorado Avenue, Santa Monica, California.

SIU--Southern Illinois University, main campus at Carbondale, Illinois.

SMSA (Standard Metropolitan Statistical Area)--Defined by the Census Bureau as "a county or group of contiguous counties which contains at least one central city of 50,000 inhabitants or more or 'twin cities' with a combined population of at least 50,000."

SoS--Secretary of State.

Spur Lines--In this study spur lines refer to common carrier leased lines used to connect a police, highways or civil defense installation to the main State microwave network. These are used for economic reasons where the volume of traffic is too small to justify the installation of microwave facilities.

Telpak--A bulk private line service which permits large communications capacities and can be used for transmission of voice, teletypewriter, facsimile, or digital data at reduced rates.

Terminal--The equipment at a location that terminates a telephone or data line. It provides the interface between a long distance line and the local distribution network.

UI--University of Illinois, main campus at Urbana, Illinois.

UHF (Ultra-high frequency)--That part of the radio frequency spectrum between 300 and 3000 megahertz.

VHF (Very-high frequency)--That part of the radio frequency spectrum between 30 and 300 megahertz.

WATS (Wide Area Telephone Service)--A service which allows customers to make an unlimited number of long distance calls within a certain region (a state or group of states) for a flat or measured monthly rate.

APPENDIX A

STATE LEGISLATION AND DOCUMENTATION

Page No.

1. California Senate Bill No. 1200. A-2
2. California State Administrative Manual Transmittal Letter No. 121. A-5
3. Idaho House Bill No. 252. A-22
4. Iowa Senate File 732. A-24
5. Massachusetts - Proposed Act. A-31
6. Massachusetts - Executive Order No. 53. A-47
7. Nebraska Legislative Bill 605. A-50
8. Pennsylvania Senate Bill No. 1685. A-58
9. South Carolina Appropriations Act of 1960, Section 9. A-64

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A-2

AMENDED IN ASSEMBLY JULY 11, 1968
AMENDED IN SENATE JUNE 19, 1968

SENATE BILL No. 1200

Introduced by Senator Schrade

April 16, 1968

REFERRED TO COMMITTEE ON GOVERNMENTAL EFFICIENCY

An act to amend Sections 15252, 15275, 15279, 15281, and 15300 of the Government Code, relating to the California State Communications Advisory Board.

The people of the State of California do enact as follows:

SECTION 1. Section 15252 of the Government Code is amended to read:

15252. The purpose of this part is to improve and coordinate the use of radio and other communications facilities owned and operated by the state, and to coordinate and cooperate with cities, counties, and other political subdivisions thereof, in order to eliminate duplications and interferences, to bring about economies which could not otherwise be obtained.

SEC. 2. Section 15275 of the Government Code is amended to read:

15275. There is in the state government the California State Communications Advisory Board which consists of:

(a) The Director of General Services.

(b) The Attorney General or his designated representative, the Adjutant General or his designated representative, the Director of the California Disaster Office or his designated representative, the Commissioner of the California Highway Patrol

LEGISLATIVE COUNSEL'S DIGEST

SB 1200, as amended, Schrade (Gov. Eff.). Communications Advisory Board.

Amends various secs., Gov.C.

Expands membership of Communications Advisory Board. Allows rather than requires the board to perform in specified areas. Deletes various responsibilities of the board. Increases expense allowance for members when attending meetings.

Vote—Majority; Appropriation—No; Fiscal Committee—Yes.

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or his designated representative, the Director of Conservation or his designated representative, the Director of Public Works or his designated representative, the Director of the Department of Water Resources or his designated representative, and a representative of the Governor.

(c) Two representatives of the law enforcement services in this state, one of whom shall be representative of city or city and county law enforcement services and shall be recommended by ~~the Law Enforcement Section of~~ the League of California Cities, and one of whom shall be representative of county law enforcement services and shall be recommended by the County Supervisors Association, appointed by the Governor subject to the confirmation of the Senate.

(d) Two representatives of the fire services in this state, one of whom shall be representative of city or city and county fire services and shall be recommended by the California Fire Chiefs Association, and one of whom shall be representative of county or district fire services and shall be recommended by the California Rural Fire ~~Chiefs~~ Association, appointed by the Governor subject to the confirmation of the Senate.

(e) Two representatives of industry at large, appointed by the Governor subject to the confirmation of the Senate.

SEC. 3. Section 15279 of the Government Code is amended to read:

15279. Of the six members of the board appointed pursuant to subdivisions (c), (d), and (e) of Section 15275 of this article, two shall be appointed for a term expiring December 31, 1948, two for a term expiring December 31, 1949, one for a term expiring December 31, 1950, and one for a term expiring December 31, 1951. Subsequent appointments in each instance shall be for terms of four years, ending on December 31st of the fourth year after the end of the prior term, except that appointments to fill vacancies occurring for any reason other than the expiration of the term shall be for the unexpired portion of the term in which they occur. The members of the board shall hold office until their successors are appointed and qualify.

SEC. 4. Section 15281 of the Government Code is amended to read:

15281. The members of the board shall not receive compensation from the state for their services under this part but, when called to attend a meeting of the board, shall be reimbursed for their actual and necessary expenses incurred in connection with such meeting, or in lieu of such expenses shall receive mileage and twenty dollars ($20) each day of actual service.

SEC. 5. Section 15300 of the Government Code is amended to read:

15300. The board may:

(a) Provide adequate representation of local and state governmental bodies and agencies before the Federal Communications Commission in matters affecting the state and its cities, counties, and other public agencies.

(b) Provide, upon request, adequate advice to state and local agencies in the state concerning existing or proposed communications facilities between any and all of the following: cities, counties, other political subdivisions of the state, state departments, agencies, boards, and commissions, and departments, agencies, boards, and commissions of other states and federal agencies.

(c) Make and adopt necessary rules and regulations affecting the board's procedure and conduct.

(d) Recommend to the appropriate state and local agencies such rules, regulations, procedures, and methods of operation as it deems necessary to effectuate the most efficient and economical use of publicly owned and operated communications facilities within this state.

(e) Provide, upon request, information and data concerning the communications facilities which are owned and operated by public agencies in connection with official business of public safety services.

(f) Carry out the policy of this part.

A-5

State of California | Revenue and Management Agency

Memorandum

To : ALL STATE AGENCIES

Date : May 1, 1968

File No.:

From : **Department of General Services**
Executive Office

Subject : STATE ADMINISTRATIVE MANUAL TRANSMITTAL LETTER NO. 121
(Revised Communications Chapter)

Attached is the revised Communications Chapter of the State Administrative Manual, Sections 4500-4583. The organization of the chapter has been improved by relocating and renumbering various sections.

Section 4505.10 requires agencies to notify Communications Division of the person named as Agency Telephone Communications Representative.

Section 4512.31 applies a standard of essentiality to the assignment of mobile radios.

Standards and requirements for authorizing installation of telephone systems, instruments, and features are set forth to provide agencies with information necessary to reduce, alter, or increase their telephone equipment. Required approvals and exemptions from approvals are stated in Sections 4520.20 and 4522.

Section 4572 states new policy regarding acquisition and use of radio vaults.

The surcharge described in Management Memo 68-11 for off-net calls to San Francisco and Los Angeles areas is incorporated.

Andrew R. Lolli
Director of General Services

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DIRECTIONS FOR SHEET REMOVAL AND INSERTION
State Administrative Manual Transmittal Letter No. 121

Before proceeding with the changes below, the revision record, which is the first sheet at the front of each manual, should be examined to see if the necessary transmittal letters have been entered so that your manual is up to date. If your manual is not up to date, please contact the State Administrative Manual Coordinator, Ext. 5-2879, to obtain needed material.

Remove	Insert
Entire Communications Section 4500 Index through 4576.33 (7 sheets)	Revised Communications Section 4500 Index through 4580 (8 sheets)

Date and initial manual revision records as follows:

Manual	Code	Revision Record No.
Complete (SAM (0000 - 19999)	A	121
General Responsibilities & Services (0000 - 5999)	B	75
Communications (4500-4599)	K	35

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STATE ADMINISTRATIVE MANUAL

COMMUNICATIONS

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COMMUNICATIONS POLICY (Rev. 5-68) 4500

It is state policy to provide efficient and economical communications as needed to support the functions of all state agencies. For all equipment, whether purchased or leased, this requires careful advance planning, adequate standards of preventive maintenance, and adequate facilities for installing, modifying and maintaining equipment at all locations.

GENERAL SERVICES' AUTHORITY FOR COMMUNICATIONS MANAGEMENT AND SUPERVISION (Rev. 5-68) 4501

Section 14931 of the Government Code authorizes the Department of General Services to acquire, install, equip, maintain and operate new or existing communications systems and facilities and to do such other acts, in the name of the State, as will provide adequate and efficient communications systems and make such systems available to state agencies.

Section 14615 grants the Department of General Services the general power of supervision over all matters concerning the financial and business policies specified in Section 14931.

COMMUNICATIONS OBJECTIVE (Rev. 5-68) 4502

The primary objective of the Communications Division, Department of General Services, is to insure that state agencies are provided essential communications services meeting their operational requirements at a minimum expenditure.

COMMUNICATIONS DIVISION FUNCTIONS AND GOALS (New 5-68) 4503

To accomplish the objective stated in Section 4502, the functions and goals of the Communications Division, Department of General Services, are as follows:

1. Developing technical plans and recommending communications facilities and equipment which will meet state agencies' operational communications requirements.
2. Continuing review and evaluation of communication facilities and equipment used by state agencies to insure their needs are being met at the lowest cost to the State.
3. Providing the engineering, installation, maintenance and management of communications facilities, equipment and services at the lowest cost to the State.
4. Developing and implementing policies, standards, practices and procedures to insure orderly development of state communications facilities in an economic and efficient manner.

DEFINITIONS (Revised 8/68) 4504

Entries in this section are limited to those terms and words for which a common definition will assist in clarifying the general terms and words used in this chapter and within the communications industry. These definitions are not intended to be a listing for procurement purposes, nor should they be viewed as a complete classification of communications equipment. Additional definitions related to telephone equipment and usage are contained within the General Services publication, "A Guide to Better Telephone Service", available from Communications Division. Other publications are available from Communications Division on particular subjects.

When used in the sections of this chapter, terms and words have meanings as follows:

ATSS -- Automatic Telecommunications Switching System (see Section 4535.)

Automatic Answering Equipment -- an arrangement whereby incoming calls are answered automatically with a pre-recorded announcement, and the calling party cannot leave a message.

Automatic Answering and Recording Equipment -- an arrangement whereby incoming calls are automatically answered and the calling party may leave a message.

Automatic Call Distributing System (ACDS) -- an arrangement which automatically distributes incoming calls evenly between a number of answering points on the common system.

Automatic Dialers -- devices which perform the dialing function for a telephone user. Some use magnetic tapes for conveniently storing and locating frequently called telephone numbers; others use prepunched tape or plastic cards.

Automatic Signal Unit (ASU) -- a one or two-way arrangement which automatically rings the called station when the calling party picks up the telephone. This equipment is associated with a separate intercommunicating line between the two stations.

Busy Lamp -- a light arrangement to indicate which line(s) on a key telephone system is in use.

Call Director -- a larger size key telephone instrument capable of terminating between eleven and twenty-nine lines. It may be provided in increments of 12, 18, 24 or 30 keys, one of which is a hold key.

Call Diverter -- a fully automatic device used to transfer incoming calls from one telephone number to another.

Call Diverting Equipment -- an arrangement which makes it possible to prevent dial PBX station users from making unauthorized local or long distance calls.

CENTREX -- an improved type of dial PBX service. It is an arrangement to serve one or more subscribers from a central switching machine located either on a subscriber's premises (CENTREX CU) or on telephone company property (CENTREX CO). CENTREX service (CU or CO) permits outside callers to dial directly to telephones within the system without going through a PBX operator. This is called direct inward dialing (DID). In certain areas, CENTREX systems also provide automatic identification of outgoing long distance or message unit calls by local telephone number (AIOD).

Code Calling Equipment -- an arrangement for sounding audible signals according to definite patterns by code sending equipment used with dial PBX or 20-40 Dial Pak systems.

Common Carrier -- as used in this chapter, refers to a commercial telephone and/or telegraph company.

Communications Equipment and Services include: All wire and electromagnetic communications such as teletype, telephone, facsimile, television, data transmission, central dictation recording equipment, sound systems, radio, telemetering, broadcasting and microwave.

Conference Equipment -- a special arrangement which enables one telephone user to conference simultaneously with several other telephone users within the same system and/or with outside calls.

Data Sets -- refers to data service which is a Common Carrier Service provided for the purpose of transmitting and/or receiving machine generated signals.

Dedicated Leased Lines -- A state leased private line facility for communication purposes other than ATSS. Most are obtained under "bulk" (TELPAK) tariff filing, and for the sole use of a specific agency.

Dial Dictation Equipment -- a special assembly of equipment that permits dial telephone station users to be connected to customer-owned dictation equipment. It may be used with Key Telephone, Dial PBX, CENTREX, or 20-40 Dial Pak systems.

(Direct) Inward Dial -- see CENTREX.

Emergency Reporting System (ERS) -- a switchboard system designed expressly for reporting and dispatching of emergencies. Up to 400 emergency telephones may be connected.

Foreign Exchange Service (FEX) -- telephone service from one service area of the telephone company into another. Example: Sacramento local service extended into Marysville.

Holding Feature (Key Telephone) -- a feature which enables holding a call while giving or obtaining information or answering a call on another line without disconnecting the first caller.

Hunting (Rotary) Line Groups -- an arrangement where several consecutive telephone numbers are grouped in a system that will "hunt" for an idle number in the group when the called number is busy. The caller would receive a busy signal only if all lines of the group were in use. Normally only the first number of the group (pilot number) will be listed.

Intercom Systems -- see Section 4521.30.

(Direct) Inward Dial -- see CENTREX.

Key Telephone Features -- any element(s) of a key telephone arrangement necessary for key operation.

Key Telephone Systems (KTS) -- a key telephone system is an arrangement of telephones, wiring and other necessary equipment which provides a means of answering one or more lines by one or more stations and to transfer calls to another station. The types of key system telephones include: push button telephones; Call Directors; panel mounted modules; ten line key units; sets with externally mounted keys; or sets with no associated key equipment, when such sets are part of a key telephone assembly.

Line Lamps -- a light arrangement to indicate which line(s) on a key telephone system is ringing.

Microwave Communications -- see Radio/Microwave Communications.

Mileage Charges -- the additional charges for stations located in a different building and beyond a certain distance from the primary station.

Off-Net ATSS Telephone Calls -- see Section 4535.1.

On-Net ATSS Telephone Calls -- see Section 4535.2.

Parallel Toll Calls -- see Section 4535.3.

PBX Systems -- the term "PBX" (Private Branch Exchange) encompasses a wide range of telephone systems which accomplish all of the following: (1) inter-communication (switching) calls between stations on the system without connecting those calls to public lines; (2) directing incoming calls from public lines; (3) connecting outgoing calls to public lines.

The range of PBX systems extends from the simplest of "manual" PBX systems (where the operator of the switchboard places, receives, and switches calls) to the extremely complex "CENTREX" PBX systems on which the caller accomplishes nearly all of the operations by dialing directly without going through a PBX operator. There are numerous other "dial" PBX systems with varying degrees of involvement by the PBX operator.

Radio/Microwave Communications -- communications that utilize radio frequencies, including radio and television broadcasting.

Radio Vaults -- the space in which specific radio/microwave equipment is located at a site established for radio/microwave communications.

Rotary Lines -- see Hunting (Rotary) Line Groups.

Sound Systems -- include: public address, paging, recording, and studio facilities.

Speaker Phone -- a microphone (transmitter) and loudspeaker (receiver) associated with a telephone. It permits a telephone conversation without using the handset.

Spokesman -- a separate loutspeaker (receiver) connected only to the receiver circuit of a telephone with a combination on-off volume switch. The handset must be off the switchhook before the Spokesman will function.

Station (Switchhook) Busy -- a light arrangement which indicates to another location that a specific telephone is being used as contrasted to a busy lamp which shows that a line is in use.

Switchboard System Telephone Calls -- see Section 4534 and PBX Systems.

Teletypewriter Service -- a communications device to transmit printed information from one teletypewriter to another teletypewriter(s) using wire line, radio, or microwave transmission facilities.

Touch-tone Calling Service -- provides for the use of push button equipped telephone instruments to originate calls - (this service is not yet generally available in California).

Wide Area Telephone Service (WATS) -- a special arrangement to permit long distance calling on a flat rate monthly charge to specifically designated areas of the state or nation.

Wink Hold -- a light arrangement on a key telephone equipped with "hold" to wink rapidly when a line is held.

6A Type Intercom -- a selective intercommunicating system with two talking paths equipped for push button or dial selecting other telephones. Visual indicators and several other special features may be provided as needed.

20-40 Dial Pak -- a small dial intercommunicating system for 20 to 40 telephones. Access to outside lines is available to the connected stations only with special attendant assistance.

400 Series Key Mountings -- a panel mounted module key telephone instrument capable of terminating from 29 to 119 lines. It may be provided in increments of 30, 60, 90 or 120 keys, one of which is a hold key.

6051 Key -- a separately mounted strip of 12 keys capable of terminating 11 lines. One of the 12 keys is a hold key.

AGENCY RESPONSIBILITIES (New 5-68) 4505

All agencies will comply with the requirements and standards stated in these chapters which are the state standards for communication facilities.

ASSIGNMENT OF AGENCY TELEPHONE COMMUNICATIONS REPRESENTATIVE(S) (Rev. & Renumbered 5-68) 4505.10

In each agency, responsibility for approval of proposed changes or additions in telephone equipment will be specifically assigned to one or more individuals. The person(s) designated must have authority to grant budgetary as well as administrative approval of the agency. Within the following sections, such persons will be referred to as "Agency Telephone Communications Representative(s)".

Agencies will advise the Communications Division of the names, titles, mailing addresses and telephone numbers of their Agency Telephone Communications Representative(s), and the geographic area for which they are responsible. Such notifications will be kept current and addressed to:

Communications Division
2025 19th Street
Sacramento, California 95818

OBTAINING TELEPHONE ASSISTANCE (Rev. & Renumbered 5-68) 4505.20

The Communications Division and the telephone industry will assist the Agency Telephone Communications Representative in meeting telephone communication requirements in conformance with the standards outlined in this chapter. (See Section 4521 et seq.)

ORDERING TELEPHONE EQUIPMENT (Rev. & Renumbered 5-68) 4505.30

To provide uniformity, orders for changes, additions, modifications, removals or relocations of telephone equipment and services (except ATSS - see Section 4512.60) shall be submitted on Standard Form 20 (Telephone Service Request), obtainable from Central Stores. Orders not requiring Communications Division approval should be sent directly to the local telephone company. (See Sections 4520-4522.) Ample time, as determined by mutual agreement with the telephone company, should be allowed for ordering of equipment prior to desired date of service.

Orders requiring Communications Division approval, other than telephone switchboards and special arrangements, must be received by Communications Division at least 60 days in advance of the desired in-service date. Orders for telephone switchboards and special arrangements require longer lead time varying from 6 to 18 months. Agencies will be advised by Communications Division of the in-service date.

REMOVAL OR RELOCATION OF TELEPHONE EQUIPMENT (Rev. & Renumbered 5-68) 4505.40

At least once a year -- or more often when changes in personnel, operations, or procedures occur -- agencies will review their need for telephone facilities and immediately order removal of any unnecessary lines, stations, or special service features. When telephone equipment is to be removed or relocated without additions, the agency will submit an order on Standard Form 20 (Telephone Service Request) directly to the local telephone company.

REVIEW OF COMMUNICATIONS PLANS AND TRANSACTIONS (Rev. & Renumbered 5-68) 4510

Certain categories of plans, proposals, expenditures and other transactions of state agencies relative to communications equipment and services require the approval of the Communications Division. The required reviews and approvals are described in the following sections. All communications proposals which require the approval of Communications Division, including communications facilities in new space (see Facilities Planning, Section 1370 ff), will be coordinated with the Communications Division at the earliest possible date.

COMMUNICATIONS DIVISION REVIEW OF AGENCIES' COMMUNICATION PROGRAM BUDGET (Rev. & Renumbered 5-68) 4511

State agencies will provide Communications Division with a copy of their proposed communications program budget no later than August 1 of each year. ("Communications program budgets" will include capital outlay, equipment, operating expense, personnel, and all other related costs for a complete project.) The agency's program budget will specifically explain the scope of the project, the purposes to be accomplished, total cost of project, existing investment of project, cost of the portion of project being budgeted, and the agency's order of priority for each project. Pursuant to Department of Finance, Budget Division instructions, Communications Division will forward a report to Budget Division on each agency's communications program budget.

The Budget Division will review such programs in the same manner as other requests from individual departments. A favorable recommendation from the Communications Division will not, therefore, automatically mean inclusion in the Governor's budget. If the Budget Division recommendation is for deferment, or if the agency suggests deferment on a priority basis, the Budget Division will inform Communications Division immediately. Communications Division will then determine what effect such deferment will have on the overall communications program.

OTHER TYPES OF REVIEW BY COMMUNICATIONS DIVISION (Rev. 5-68) 4512

In addition to the budget review process outlined in Section 4511, the Communications Division will review plans and proposed transactions of agencies as follows:

TELEPHONE EQUIPMENT - REVIEW (Revised 8/68) 4512.10

Review of plans and transactions related to leased or state-owned telephone equipment vary according to the usage and type of equipment involved. Sections 4520ff deal with this subject in greater detail.

CONTRACTS FOR COMMUNICATIONS AND ELECTRONIC SERVICE (NON-TARIFF) - REVIEW (Rev. 8/68) 4512.20

Communications Division will be contacted prior to actual negotiation of details in contracts for communications and electronic services. All proposed agency contracts (Form 2) for such services, including telephone maintenance service, shall be reviewed by the Communications Division.

PURCHASES OF EQUIPMENT - REVIEW (Revised 8/68) 4512.30

Communications, electronic and sound equipment will be purchased according to standard specifications developed by the Communications Division. All purchase estimates for such equipment shall be reviewed by the Communications Division.

RADIO/MICROWAVE - REVIEW (Revised 8/68) 4512.40

All plans or transactions of agencies related to technical radio/microwave facilities and equipment require extensive assistance, review and coordination with the Communications Division. Sections 4570ff deal with this subject in greater detail.

SOUND SYSTEMS - REVIEW (Revised 8/68) 4512.50

The requirements and specifications for sound systems (see definition in Section 4504) to be installed for state agencies will be coordinated with Communications Division in the early planning stage. (See also Sections 4512.20 - 4512.30.)

CONNECTION TO THE ATSS NETWORK - REVIEW (Revised 8/68) 4512.60

The addition of new locations to the ATSS network involves engineering considerations to prevent a decrease in existing ATSS grade of service as well as economic considerations.

In order to coordinate the ATSS system, no tie-line(s) or off-premises line(s) for ATSS service will be added without the prior approval of the Communications Division. State agencies desiring connections, additions, modifications, removals or relocation of tie-line or off-premise lines will submit Standard Form 21 (ATSS Service Request), available from Central Stores, at least 60 days prior to the month of authorization.

"DEDICATED" LEASED LINES - REVIEW (Revised 8/68) 4512.70

Requests for dedicated private line facilities shall be reviewed by the Communications Division. Submit requests on Form COM-2585, available from Communications Division, at least 60 days prior to in-service date.

DISPOSITION OF STATE-OWNED TELEPHONE SYSTEMS - REVIEW (New 8/68) 4512.80

Proposals to sell a state-owned telephone system shall be reviewed by the Communications Division.

STANDARDS AND REQUIREMENTS FOR AUTHORIZING TELEPHONE SYSTEMS, INSTRUMENTS AND FEATURES (Rev. & Renumbered 5-68) 4520

Section 4521 contains standards for authorizing telephone equipment and services. Section 4522 identifies the requirements for approvals prior to ordering certain types of equipment or services. These standards and requirements will assist in minimizing agency telephone expenditures while maintaining essential telephone services.

REVIEW OF EXISTING TELEPHONE EQUIPMENT AND SERVICES (Rev. & Renumbered 5-68) 4520.10

Periodically, personnel of the Communications Division or other qualified personnel designated by General Services will review existing telephone services of state agencies to evaluate usage, need, and compliance with pertinent standards.

EXCEPTIONS TO STANDARDS (New 5-68) 4520.20

Where agency needs require equipment or service which exceeds the standards, a request for exception may be submitted to the Communications Division. Requests will contain justification for the exception including the following factors stated in terms of a period sufficient to demonstrate the need:

1. The number of calls;
2. The type of calls - incoming and outgoing, public or state, confidential or otherwise;
3. The length of the calls;
4. The time pattern of the calls throughout the day;
5. The urgency or importance of the calls.

USE OF STANDARDS BY AGENCIES (New 5-68) 4520.30

Agency Telephone Communications Representatives - without prior approval of the Communications Division - may authorize a common carrier to install equipment or arrange for telephone services which do not exceed the standards contained in the following sections.

TELEPHONE EQUIPMENT AND SERVICE STANDARDS (Rev. & Renumbered 5-68) 4521

SINGLE LINE STANDARDS (Rev. & Renumbered 5-68) 4521.10

1. A user with an average of less than 30 calls per day may be authorized a single line instrument.

2. A group of users with an average combined total of daily calls that is less than 30 may be authorized a single line instrument and necessary extensions.

MULTIPLE LINE AND HOLD FEATURE STANDARDS (Rev. & Renumbered 5-68) 4521.20

1. A group of users with an average combined total of daily calls exceeding 30 may be authorized push button telephones, subject to the requirements and limitations contained in Section 4522.

2. Any user having frequent need to hold calls on instruments equipped with 2 or more lines may be authorized a hold feature.

SUPPLEMENTAL INTERCOM SYSTEMS TO BASIC TELEPHONE SERVICE - STANDARDS (Rev. & Renumbered 5-68) 4521.30

1. Supplemental telephone intercom service in addition to basic telephone service may be authorized when:

   a. There is a need for calls to be answered at a central point, then routed to various persons.

b. There are so many telephone calls between stations of the key system that the installation of an intercom would eliminate the need for additional main lines.

2. Signaling by a button and buzzer system or a Dial Selective Signaling system, whichever is the least expensive, may be authorized for use with an inter-communicating line when a number of stations must be signaled. If a situation only requires that there be a signal indicating which telephone line is to be answered, a simple button and buzzer system using code signaling -- without an intercommunicating line -- may be authorized.

CENTRALIZED OR MULTIPLE ANSWERING - STANDARDS (Rev. & Renumbered 5-68) 4521.40

Centralized or multiple answering may be authorized when it is necessary to have calls "screened", then directed to the proper person(s), or when a telephone must be answered when the person who normally answers is absent.

LINE LAMPS, LINE BUSY LAMPS, VISUALS - STANDARDS (Rev. & Renumbered 5-68) 4521.50

Visual features may be authorized only where three or more main lines appear at a station which will answer those lines. Toned bells are sufficient to differentiate between two lines.

LINES IN ROTARY (Rev. & Renumbered 5-68) 4521.60

When usage requirements indicate more than one line is needed in accordance with the standards (see Section 4521.20), consideration should be given to the use of "rotary" or "hunting lines". These lines are capable of handling a substantially greater number of calls at a particular grade of service than the same number of individual or "remote" lines. There is no difference between the monthly charges for "rotary" or "hunting" and "remote" lines except for the additional charges for key telephone features.

TELEPHONE SERVICE OR EQUIPMENT THAT REQUIRES COMMUNICATIONS DIVISION APPROVAL (New 5-68) 4522

This section specifies the types of equipment and services which may be ordered only after specific approval has been obtained from Communications Division.

A. Any key system on a CENTREX or PBX that:

1. Involves a monthly mileage charge exceeding the cost of a seperate individual line business service.

2. Has an average of less than two stations per line within a key system.

B. All key equipment for use with new CENTREX type telephone systems.

C. Any system proposing to have any of the following items:

1. More than one central answering location.
2. Direct outside lines on CENTREX or PBX systems.
3. "Station" or "Switchhook" busy features.
4. Addition of a line or lines to a two-line key system.
5. Wink hold.
6. Any CENTREX or other PBX (dial or manual).
7. Automatic Call Distributing Systems (ACDS).
8. 20-40 Dial Pak.
9. All Foreign Exchange Service or WATS lines.
10. PBX trunks.
11. Automatic Two Point Voice Circuit-type intercom (ASU).
12. 6A type intercom.
13. Conferencing equipment.
14. Call Directors, 400 Series Key Equipment, 6051 Keys (KU2).
15. Color phones.
16. Starlite, Princess or similar-types of instruments.
17. Special assemblies or non-standard equipment.
18. Speakerphone, Spokesman or similar units.
19. Loud speaker intercom and loud speaker paging.
20. Automatic answering and/or recording equipment.

21. Call diverting equipment.
22. Alarm or emergency reporting systems.
23. Tone signaling equipment and facilities (Touch-tone).
24. Data sets.
25. Transmission and/or switching facilities needed for business machine equipment.
26. Any teletypewriter service or supplementary equipment.
27. Card or automatic dialers.
28. Dial dictation facilities.
29. Code call equipment.
30. Call diverters.

RESPONSIBILITIES FOR CORRECT TELEPHONE USAGE (Rev. & Renumbered 5-68) 4531

Each agency is responsible for the enforcement of the following policies, instructions and controls related to telephone usage, and for related training of personnel. Agencies are encouraged to develop supplementary telephone usage policy and instructions which are appropriate for the particular needs of the agency.

ANSWERING AND PLACING CALLS (New 5-68) 4532

Telephone users should -- when consistent with the operation of the agency -- answer and place their own calls in order to improve efficiency. State telephones should be answered with identification of the office and the party speaking. Telephone users should also identify themselves to the called party.

PERSONAL USE (Rev. & Renumbered 5-68) 4533

State telephones are provided for the conduct of state business. Agencies will formulate or adopt policies to control the use of state phones for personal calls and inform all employees of such policies. Agency policy must be consistent with the following statewide prohibitions and considerations:

PROHIBITIONS:

1. Personal long distance calls will not be made from state telephones unless arrangements are made with the long distance telephone operator at the time the call is placed to have the call billed to the caller's home telephone or to place the call "collect".

2. Personal long distance calls will not be made over state leased lines (ATSS).

For purposes of this section "long distance" -- in addition to its usual meaning -- includes any call involving one or more message units. (There are added expenses to the State because of message unit charges for calls in the Los Angeles, San Francisco Bay, and San Jose areas.)

CONSIDERATIONS:

1. Pay telephones are generally available (or can be installed) for personal use by state employees.

2. Most personal calls (with the exception of emergency calls) can be made during break or at lunch time.

Agency policy relative to personal calls on state telephones should firmly assign responsibilities to first line supervisors which include:

1. Enforcement of the above statewide prohibitions.

2. Insuring that both incoming and outgoing personal calls do not interfere with the conduct of state business.

3. Determining the manner in which permission is obtained to make personal calls on state telephones.

4. Minimizing the frequency and duration of incoming and outgoing personal calls that are costly to the State because of telephone charges and lost personnel time.

LOCAL CALLS (Rev. & Renumbered 5-68) 4534

Local calls to state offices that are on the same telephone system as the instrument of the caller must be made by dialing only the desired extension number (5 digits or less). Local telephone calls to state offices on the same telephone system must not be made by dialing access codes and using ATSS lines or by dialing 9 and using public lines.

Local calls to locations that are not on the same telephone system as the instrument of the caller must be made by dialing 9 (to get a public line), then the proper 7 digit number. Such calls must not be made by dialing network access codes and using ATSS lines.

ATSS (LEASED LINE) CALLS (Rev. & Renumbered 5-68) 4535

The ATSS system must be used for state business calls. It costs only one-fifth as much to call during non-busy hours. (See Section 4551.) In any case where a distant number can be reached by ATSS (either "on" or "off-net", see Section 4535.1-.2), it is an unnecessary state expenditure to call such a number by a "parallel toll call" on public lines. (See Section 4535.3.) ATSS (leased line) calls should not be regarded as "free" because the charges made to an agency for ATSS service are dependent on the total number of minutes of ATSS usage and the number of ATSS circuits required. (See Section 4581.) The State Telephone Directory contains full instructions on the proper use of the ATSS system under the section titled "Leased Line (ATSS) Usage", plus complete listings of ATSS numbers.

OFF-NET ATSS CALLS (New 5-68) 4535.1

Whenever a call is placed via ATSS by dialing the access code, the area code and the 7 digit number of the party being called, such a call is referred to as an "off-net" ATSS call. The State Telephone Directory contains a listing of the cities and "off-net" prefixes that can be reached via ATSS. Those state offices not directly connected to the ATSS network and other businesses and governmental outlets having a telephone prefix listed in the State Directory as an ATSS "off-net" prefix can be reached via ATSS by following the instructions detailed in the directory.

ATSS OFF-NET SURCHARGE (New 5-68) 4535.11

A surcharge is made for off-net calls to the Los Angeles and San Francisco areas. The surcharge allocates the additional expense generated by agencies making off-net calls to these areas. (See Section 4551.1.)

"ON-NET" ATSS CALLS (New 5-68) 4535.2

Whenever a call is placed via ATSS by dialing the access code, then dialing the 7 digits listed in the State Directory in the column headed "Leased Number", the call is made entirely on the ATSS leased line network. Such calls are referred to as ATSS "on-net" calls. Calls between most state offices can be placed "on-net".

ATSS COLLECT CALLS FROM OFF-NET TELEPHONES (New 11/1/68) 4535.21

State employees in the Sacramento, San Francisco, and Los Angeles areas may place collect leased-line calls from off-net telephones, i.e., non-state telephones and state telephones not connected to the ATSS network. Such calls, however, due to telephone company regulations, must terminate at locations which are part of the ATSS network.

The following procedure will be used by employees making use of this service:

1. In Sacramento, dial 445-4711
   In San Francisco, dial 557-2123
   In Los Angeles, dial 620-3030
2. Give your name, department, and unit to the operator.
3. Give the city and ATSS number you wish to call.

4. The operator will call the number and determine if the person being called will accept the collect call.

5. If the person being called accepts the collect call, it will be completed.

If the calling party is not a state employee or refuses to give the information required, the call will not be placed. The operator will not provide ATSS information service or provide ATSS phone numbers. If the person being called is not willing to accept the call, it will not be completed.

PARALLEL TOLL CALLS (Revised & Renumbered 5/68) 4535.3

Long distance (toll) calls that could have been made via ATSS (either "on" or "off-net") are "parallel toll calls". State agencies are responsible for eliminating parallel toll calls as these are an unnecessary state expense. For example, the cost of a three-minute leased line call from Sacramento to Los Angeles during the day costs about one-sixth as much as a parallel toll call. The Department of General Services provides a monthly list of toll calls paralleling leased lines from certain locations throughout the state.

LONG DISTANCE AND MESSAGE UNIT CALLS (Revised & Renumbered 5/68) 4536

All long distance calls, including ATSS, are an expense to the State, although it is significantly less expensive to call a distant location via ATSS. Message unit calls that are placed within the Los Angeles area (213) and the San Francisco area (415) are not to be placed over the ATSS system.

TELEPHONE CREDIT CARDS (Rev. & Renumbered 5-68) 4537

State employees who need to make official long distance telephone calls while away from their office telephones at locations where access to the ATSS network cannot be obtained, may request telephone credit cards from an authorized Agency Representative. The use of such cards will eliminate additional service charges.

DIRECT DISTANCE DIALING - RESTRICTIONS (Rev. & Renumbered 5-68) 4538

When making long distance (toll) calls on any switchboard serving more than one agency (except ATSS and CENTREX systems), Direct Distance Dialing Service shall not be used unless specific instructions are provided by the agency operating the switchboard.

PERSON-TO-PERSON CALLS (Rev. & Renumbered 5-68) 4539

Rates for person-to-person toll calls average 80 percent above station-to-station rates. The savings possible through elimination of payment of higher rates for person-to-person toll calls should more than offset the cost of occasional additional calls to contact a particular individual on a station-to-station basis.

Attention is called to the fact that, except on ATSS, person-to-person rates are charged if an extension number is requested on a station-to-station call.

BILLING FOR TELEPHONE SERVICES (Rev. & Renumbered 5-68) 4550

ATSS (LEASED LINE) BILLING (Rev. & Renumbered 5-68) 4551

Agencies are invoiced for ATSS service based on the number of minutes of usage. Monthly bills are based on usage made two months previously, e.g., February bills are based on December usage.

The ATSS network is leased from the telephone company on a twenty-four hour, seven day a week basis. Reductions or additions to the network are ordered by General Services dependent upon the usage by state agencies. Telephone users on the ATSS network may reduce costs by making calls at non-busy hours as detailed below:

Busy hours - 8 a.m. to 12 noon and 1 p.m. to 5 p.m. - 7¢ per minute (approximate)

Non-busy hours - 12 noon to 1 p.m. and 5 p.m. to 8 a.m. - 1.4¢ per minute (approximate)

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Agencies having switchboard service through one of the General Services' CENTREXES receive a tabulation of random sampled ATSS calls, i.e., telephone numbers of callers and those called, arranged by date, time, and length of call.

OFF-NET SURCHARGE (New 5/68) 4551.1

The surcharge for off-net calls is:

a. Los Angeles (Area Code 213) $0.048 per minute (approximate)
b. San Francisco (Area Code 415) $0.035 per minute (approximate).

The surcharge will apply regardless of the time of the day that the call is made.

OPERATOR SURCHARGE (New 11/1/68) 4551.11

A surcharge of approximately ten cents per call will be added to the normal ATSS bill of the department receiving an ATSS collect call from off-net telephones via General Services switchboards in Sacramento, San Francisco, and Los Angeles.

BILLING TO AGENCIES SERVED BY GENERAL SERVICES SWITCHBOARD (Revised & Renumbered 5/68) 4552

The Department of General Services operates several central switchboards and submits telephone bills to the agencies served. (See Section 8422.106.) These bills are based on the charges for equipment, toll calls, and pro rata of common equipment and operator cost.

TELEGRAM TRANSMISSION (Rev. & Renumbered 5-68) 4560

Messages to be dispatched by telegram should be reviewed to:

1. Insure that messages are sent only when immediate written record is required, or it is the only practical means of transmission.
2. Insure brevity and conciseness.
3. Insure that the lowest classification is assigned to the message consistent with the subject matter, i.e., classify as night letter rather than straight day message.
4. Insure that the agency to be billed for the cost of the message appears at the bottom of the message.

RADIO/MICROWAVE FACILITIES (Rev. & Renumbered 5-68) 4570

AGENCY RADIO VAULTS ON GENERAL SERVICES' PROPERTY (Rev. & Renumbered 5-68) 4571

Where state agencies own or construct radio vaults on sites acquired by General Services, the vaults will remain the property of the agency. Agencies will be billed for the use of the land at a flat annual rate per vault.

OCCUPANCY OF RADIO VAULTS - PROCEDURE AND BILLING (Rev. & Renumbered 5-68) 4572

Any agency desiring occupancy of radio vault space shall obtain the permission of the agency controlling the space, with the technical concurrence of the Communications Division. Formal Interagency Agreements shall no longer be required where radio vault space is used by one state agency and controlled by another state agency. Effective June 30, 1968, all such existing Interagency Agreements covering occupancy of radio vault space will terminate.

The agency controlling the radio vault space shall bill the using agency annually at a mutually agreed rate.

ACQUIRING COMMUNICATIONS SITES (Rev. & Renumbered 5-68) 4573

Sites for a communications installation will be acquired only after the technical approval of Communications Division has been obtained. All lands and rights-of-way for sites shall be acquired in the name of the State of California whenever possible. Leases for sites will be negotiated so that there shall be no restriction against or additional charges for the use of the sites -- or facilities thereon -- by additional state agencies whenever possible.

The negotiation of leases shall be coordinated with Communications Division to assure that the acquisition of sites is adequate for present and future communications development for all agencies.

LEASES OF COMMUNICATIONS SITES TO NON-STATE INTERESTS (Rev. & Renumbered 5-68) 4574

All requests by other than state agencies for use of state controlled property as communications sites will be technically reviewed and approved by the Communications Division before any action is taken toward granting any easement, permit, or other conveyance of such lands.

F.C.C. LICENSES AND PERMITS (Rev. & Renumbered 5-68) 4575

Construction and operation of all state-owned and operated communications facilities utilizing radio frequencies are subject to the rules and regulations of the Federal Communications Commission. All requests to the F.C.C. concerning licenses, permits, or other information regarding state-owned or operated equipment will be processed by the Communications Division.

The use of state radio frequencies by non-state users (or vice versa) is subject to strict F.C.C. rules. Agencies should review with Communications Division any proposed agreements for such joint use to avoid violations of F.C.C. rules and subsequent penalties.

MOBILE RADIO ASSIGNMENT STANDARD (Renumbered 8/68) 4576

Mobile radio equipment should be installed in only those vehicles which are assigned principally to personnel whose operational duties make such equipment essential.

SERVICES PROVIDED BY THE COMMUNICATIONS DIVISION (New 5-68) 4580

ENGINEERING SERVICES (Rev. & Renumbered 5-68) 4581

The engineering service provided by Communications Division includes the planning, design, layout, field survey, specifications, and obtaining F.C.C. licenses for all types of communications systems, and the engineering related to installation and maintenance.

CHARGES FOR ENGINEERING SERVICES (Rev. & Renumbered 5-68) 4581.1

Agencies will be billed to recover the cost of the engineering services performed.

INSTALLATION AND MODIFICATION SERVICES (Rev. & Renumbered 5-68) 4582

Communications Division performs the installation and modification work as requested by the agencies.

Agencies will submit a Form COM-207, "Job Tag Radio Work Authorization", for the work desired at least 30 days in advance of the date that the work is scheduled to begin.

CHARGES FOR INSTALLATION AND MODIFICATION SERVICES (Rev. & Renumbered 5-68) 4582.1

Agencies will be billed at actual costs for each specific job.

MAINTENANCE SERVICE (Rev. & Renumbered 5-68) 4583

Communications Division provides maintenance service including labor and replacement parts necessary to maintain units in proper operating condition.

CHARGES FOR MAINTENANCE SERVICE (Rev. & Renumbered 5-68) 4583.1

The cost of Communications Division maintenance service is determined by the level of service and amount of maintenance requested by the agency. Agencies will be billed to recover the costs for radio maintenance services performed.

In the House of Representatives

H. B. No. 252

By STATE AFFAIRS COMMITTEE

AN ACT

CREATING A DIVISION OF COMMUNICATIONS IN THE DEPARTMENT OF ADMINISTRATIVE SERVICES; PROVIDING FOR THE APPOINTMENT OF AN ADMINISTRATOR FOR THE DIVISION; PROVIDING FOR THE POWERS AND DUTIES OF THE DIVISION; PROVIDING FOR THE IMPLEMENTATION OF THIS ACT; PROVIDING THAT THIS ACT SHALL NOT AFFECT THE RIGHTS AND PRIVILEGES OF EMPLOYEES TRANSFERRED TO THE DIVISION; AND PROVIDING AN EFFECTIVE DATE.

Be It Enacted by the Legislature of the State of Idaho:

SECTION 1. There is hereby created the division of communications in the department of administrative services. The director of administrative services shall appoint an administrator for the division of communications, subject to the approval of the governor, and subject to the rules and regulations governing all state employees. The administrator for communications may employ and fix the compensation of such additional personnel as may be necessary.

SECTION 2. The division of communications is hereby authorized and directed:

(1) To control and approve the additional installation of all communications equipment and facilities for all departments and institutions of state government. In approving the installation of additional communications equipment or facilities, the division shall first consult with and consider the recommendations and advice of the directors or executive heads of the various departments or institutions.

(2) To receive and hold, upon order of the board of examiners, physical custody of such existing communications equipment and facilities utilized by or in the possession of any department or institution, as may be necessary to carry out the purposes of this act.

(3) To provide a system of communications for all departments and institutions of state government. The division of communications shall prescribe adequate rules and regulations for the use of any communications equipment and facilities now in use or hereafter made available.

(4) To provide a means whereby political subdivisions of the state may utilize the state communications system, upon such terms and under such conditions as the division may establish.

(5) To accept federal funds granted by congress or by executive order for all or any of the purposes of this act, as well as gifts and donations from individuals and private organizations or foundations.

SECTION 3. In order to provide for the orderly implementation of this act and to provide an economical, efficient, and effective system of communications for the state, the board of examiners may order such transfer of appropriated funds, custody and control of equipment and facilities, and employees to the division of communications as may be necessary to carry out the purposes of this act.

SECTION 4. The provisions of this act shall in no manner affect the rights or privileges of any employee transferred to the division of communications under the public employees retirement system (Chapter 13, Title 59, Idaho Code), the group insurance plan (Chapter 12, Title 59, Idaho Code), or personnel system (Chapter 53, Title 67, Idaho Code).

SECTION 5. This act shall be in full force and effect from and after July 1, 1967.

SENATE FILE 732

AN ACT

RELATING TO STATE COMMUNICATIONS AND EDUCATIONAL RADIO AND TELEVISION AND MAKING AN APPROPRIATION THEREFOR.

BE IT ENACTED BY THE GENERAL ASSEMBLY OF THE STATE OF IOWA:

Section 1. It is the intent of the general assembly in providing for state communications, that an educational radio and television facility, including provision for closed circuit television, be established to serve the entire state, and that communications of state government be coordinated to effect maximum practical consolidation and joint use of communications services.

Sec. 2. When used in this Act, unless the context otherwise requires:

a. "State communications" means a system to serve communications needs of state departments and agencies.

b. "Division" means the communications division of the state comptroller's office.

c. "Council" means the communications advisory council.

d. "Radio and television facility" means transmitters, towers, studios, and all necessary associated equipment for educational broadcasting.

e. "Board" means the educational radio and television facility board.

Sec. 3. The administration of state communications shall be vested in the office of the state comptroller. A director of the division shall be appointed by and serve at the pleasure of the comptroller with the approval of the governor. The director shall not be included in the merit system.. All councils, boards, and commissions created by this Act shall be placed, for administrative purposes, in the office of the state comptroller. The comptroller shall fix the director's compensation if it is not otherwise provided by law.

Sec. 4. The director shall promulgate rules and regulations relating to state communications in accordance with the provisions of this Act. The director shall also adopt and provide for standard communications procedures and policies to be used by all departments and agencies of state government.

Communications activities of departments of state government which affect the overall operation of state communications shall fall within the administrative jurisdiction of the division for review and action upon request from any department of state government.

Communications activities which are operational and the responsibility of a particular department of state government shall continue to fall within the administrative jurisdiction of that department of state government and be financed through its appropriations.

The communications division and the state educational radio and television facility board shall coordinate their activities to achieve the maximum possible cooperation and effective use of the available services and facilities.

Sec. 5. The state communications advisory council shall provide guidance to the division in the development, administration, unification and standardization of communication services to meet normal and emergency requirements of all state departments. The council shall consist of the following persons or their designated representatives:

1. The superintendent of public instruction.
2. The commissioner of public safety.
3. The adjutant general.
4. The chairman of the Iowa highway commission.
5. The president of the state board of regents.
6. The chairman of the council on social services.
7. The chairman of the state educational radio and television facility board.

Sec. 6. There is hereby created a state educational radio and television facility board for the purpose of planning, establishing, and operating an educational radio and television facility and such other communications services as may prove necessary in aid of the accomplishment of the educational objectives of the state.

Sec. 7. The board shall be composed of nine (9) members who shall be selected in the following manner:

1. Three (3) members shall be appointed by the state board of public instruction from its own membership or from the personnel of the state department of public instruction.

2. Three (3) members shall be appointed by the state board of regents from its own membership or from among its employees or employees of institutions under the jurisdiction of the board.

3. Three (3) members shall be appointed by the governor, at least one (1) of whom shall be from a regionally accredited

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private four-year college or university.

Sec. 8. Terms of office for members of the board shall be for three (3) years. Initial appointments in each of the three (3) categories of appointment provided in section seven (7) of this Act shall be for one (1), two (2), and three (3) years respectively, and thereafter all appointments, except appointments to fill a vacancy shall be for a term of three (3) years. Terms shall commence on July 1 of the year of the appointment.

Sec. 9. A vacancy on the board shall be as defined in section two hundred seventy-seven point twenty-nine (277.29), Code 1966, insofar as applicable. Termination of qualifying employment, under any of the categories of appointment specified in section seven (7) of this Act shall also create a vacancy. Vacancies shall be filled by the authority making the original appointment of the person whose membership has been vacated.

Sec. 10. The council and board shall each elect from their respective memberships a chairman and vice-chairman who shall each serve for one (1) year and who may be reelected. Membership on the council or board shall not constitute holding a public office and members shall not be required to take and file oaths of office before serving. No member shall be disqualified from holding any public office or employment by reason of his appointment or membership on either the council or the board nor shall any member forfeit any such office or employment by reason of his appointment to the council or board, notwithstanding the provisions of any general, special or local law, ordinance or city charter.

Sec. 11. The members of both the council and the board shall serve without compensation but shall be entitled to travel and actual and necessary expenses involved in attending meetings and in the performance of their duties.

Sec. 12. Both the council and the board shall meet separately at least four (4) times each year and shall hold special meetings when called by the appropriate chairman or in the absence of the chairman by the vice-chairman or by the chairman upon written request of four (4) members. Both the council and the board shall establish procedures and requirements with respect to quorum, place and conduct of meetings.

Sec. 13. The board shall appoint at least two (2) advisory committees as follows:

1. Advisory committee on general operations and policy.
2. Advisory committee on curricula and educational matters.

Duties of said advisory committees, and such additional advisory committees as the board may from time to time appoint, shall be specified in rules of internal management adopted by the board.

Sec. 14. The board, the governor, or the state comptroller may apply for and accept federal or nonfederal gifts, loans, or grants of funds and to use the same to pay all or part of the cost of carrying out any project under the provisions of this Act.

Sec. 15. The board shall have power to purchase or lease property, equipment, and services and to improve same for proper educational communications uses, and to dispose of property and equipment when not necessary for their purposes.

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Sec. 16. The board shall make applications for all necessary channels, frequencies, licenses, and permits in aid of carrying out their purposes.

Sec. 17. The board and division may arrange for joint use of available services and facilities.

No charge or fee shall be paid by the state of Iowa or any of its boards, commissions, agencies, and departments for any installation of any communication equipment, or rate for the use thereof if the attorney general has filed a complaint on behalf of the state of Iowa questioning the fairness and reasonableness of said charge, rate or fee, unless the Iowa commerce commission shall upon hearing affirmatively find that such charge, fee, and rate is fair and reasonable.

Sec. 18. The board shall appoint a director who shall not be included in the Iowa merit system and fix his compensation if it is not otherwise provided by law. All appointments of personnel needed to administer this Act shall be without reference to political party affiliation, religious beliefs, sex, marital status, race, color, or national origin. The total amount of compensation for employees shall be subject to the limitation of the appropriation and other funds lawfully available.

Sec. 19. Nothing in this Act shall prohibit local boards of education from owning, operating, improving, and maintaining educational radio and television stations and transmitters now in existence and operation. Local boards of education are hereby empowered and authorized to enter into such agreements with the state educational radio and television facility board as are contemplated in section fifteen (15) of this Act.

Sec. 20. There is hereby appropriated from the general fund of the state to the educational radio and television network board the sum of five hundred thousand (500,000.00) dollars for implementation of an educational television system in the state of Iowa.

ROBERT D. FULTON
President of the Senate

MAURICE E. BARINGER
Speaker of the House

I hereby certify that this bill originated in the Senate and is known as Senate File 732, Sixty-second General Assembly.

AL MEACHAM
Secretary of the Senate

Approved ____________________, 1967

HAROLD E. HUGHES
Governor

COMMONWEALTH OF MASSACHUSETTS

AN ACT relating to telecommunications; and to provide for the coordination of all state telecommunications services and facilities.

Be it enacted by the Senate and House of Representatives, in General Court assembled and by the authority of the same, as follows:

Section 1. It is hereby declared that an efficient and reliable telecommunications system is vital to the security and welfare of the Commonwealth during times of emergency and in the conduct of regular business of the Commonwealth and that substantial economies can be effected by joint use of a consolidated telecommunications system by departments, agencies, and subdivisions of state government. It is, therefore, declared to be the purpose of this act and the policy of the Commonwealth to provide for the development of an efficient and reliable telecommunications system for joint use by departments, agencies, and subdivisions of state government, to effect maximum practical consolidation and joint use of existing telecommunications facilities and services owned or used by the Commonwealth, and generally to coordinate all telecommunications functions and activities of state government.

Section 2. As used in this act, unless the context otherwise requires:

(1) Advisory Council shall mean the State Telecommunications Advisory Council;

(2) Director shall mean the Telecommunications Director/ Special Assistant to the Governor for Telecommunications;

(3) Bureau shall mean the Telecommunications Bureau of the Executive Office for Administration and Finance, within the Central Services Division;

(4) State Telecommunications System shall mean the total telecommunications facilities and equipment owned, leased, or used by all departments, agencies, and subdivisions of state government; and

(5) Telecommunication shall mean any transmission, emission, or reception of signs, signals, writing, images, and sounds or intelligence of any nature by wire, radio, optical, or other electromagnetic systems.

Section 3. There is hereby created, within the Executive Office for Administration and Finance in the Central Services Division, a telecommunications Bureau to be headed by a Telecommunications Director. The Commissioner of Administration and Finance shall appoint as Director of Telecommunications/Special Assistant to the Governor for Telecommunications any person who has not less than three years' experience in a position or positions which include responsibility for management, purchase, lease, or control of telecommunications for a private or governmental enterprise. No person shall hold the position of Director of Telecommunications/Special Assistant to the Governor for Telecommunications who is directly or indirectly interested in any telecommunications common carrier or other company engaged in the furnishing of telecommunications services or facilities, but investment in stock of a telecommunications common carrier in an amount of less than one percent of the stock of said corporation shall not be considered disqualifying. The Commissioner of Administration and Finance shall appoint such other professional and nonprofessional personnel as the Commissioner deems necessary.

Section 4. The Director of Telecommunications shall not be subject to Chapter thirty one.

Section 5. The Director shall have the following duties, powers and responsibilities:

(1) To coordinate the purchase, lease, and use of telecommunications services for state government;

(2) To advise departments and agencies of the Commonwealth and political subdivisions thereof as to systems or methods to be used to meet requirements efficiently and effectively;

(3) To consolidate the telecommunications systems and services of state agencies so far as practical and to provide for their joint use by the agencies;

(4) To assume management responsibility for any consolidated system or service;

(5) To enter into agreements for the mutual support and use of telecommunications services of the agencies and departments of state government and its political subdivisions;

(6) To provide for the rendering of mutual aid between state government and its political subdivisions and to cooperate with other states and the federal government with respect

to the organizing of telecommunication in expediting the carrying out of mutual aid in anticipation of emergencies;

(7) To use or acquire telecommunications facilities now owned or operated by any state agency and to compensate such agency when appropriate;

(8) To standardize policies and procedures for the use of such services;

(9) To assume responsibility for the maintenance and repair of state-owned telecommunications facilities so far as practical;

(10) To coordinate and consolidate maintenance and repair procedures and facilities so far as possible in the light of good business practice and the requirements of the agencies and departments concerned;

(11) To contract with consultants, qualified suppliers' and telecommunications common carriers for telecommunications facilities or services, lease of services, purchase, construction of facilities;

(12) To apply for, receive, and hold, or, if appropriate, assist agencies in applying for, receiving, or holding such authorizations, licenses, and allocations of channels and frequencies as are necessary to carry out the purposes of this act;

(13) To acquire real estate, equipment, and other property as an agency of the Commonwealth, subject to the provisions of section 6 of this act;

(14) To cooperate with the Civil Defense Agency as to its emergency telecommunications services;

(15) To insure that telecommunications facilities are not used for any purpose which is contrary to the policy and intent of this act or contrary to the laws and agreements under which the facilities are to be utilized;

(16) To take such other actions as may be necessary or desirable to ensure the provision of efficient and effective telecommunication services for state purposes.

Section 6. There is hereby established a State Telecommunications Advisory Council which shall consist of the Adjutant General, the Commissioners of the Department of Education, Public Works, Public Safety, Natural Resources, Mental Health, Public Health, Welfare and the Metropolitan District Commission, the Registrar of Motor Vehicles, the Deputy Commissioner for Central Services in the Executive Office for Administration and Finance, the Director of Civil Defense, and such other State officials as the Governor may

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from time to time designate. The Advisory Council shall organize by electing one of its members as chairman, who shall serve for a period of one year and may succeed himself in this office if reelected by the Advisory Council. It shall meet at least four times a year or upon call of the chairman, the Telecommunications Director, or any four members of the Advisory Council. The Advisory Council shall provide advice in the development, management, administration, and operation of a consolidated telecommunications system to meet the telecommunications requirements of all departments and agencies of state government. Advisory Council members shall receive no compensation for duties performed as members of the Advisory Council, but shall be reimbursed for actual expenses incurred while engaged in the performance of their duties under the provisions of this act.

Section 7. The Bureau shall have authority to purchase or lease telecommunications facilities, services, or channels on terms which are for the best interests of the Commonwealth of Massachusetts. In making the decision as to what proposal is for the best interests of the Commonwealth, the decision of the Bureau shall be based upon, but not necessarily limited to, (1) the total cost to the Commonwealth, computed in accordance with accepted governmental costs accounting procedures, taking into account taxes to be paid or foregone, interest rates, and obsolescence; (2) the quality of the service offered; (3) the comprehensiveness of the proposed facilities or plan; (4) the financial responsibility of the supplier or carrier submitting the proposal; (5) the repair and maintenance capabilities of the supplier or carrier; (6) the experience as a telecommunications carrier or supplier, as applicable; and (7) the alternate methods or facilities available.

Section 8. Personnel of all departments, offices, and agencies of the Commonwealth shall cooperate and assist to the maximum extent possible in the consolidation and joint use of telecommunications systems and services used by and under the direction of such departments or agencies.

Section 9. The Commissioner of Administration and Finance may direct the Telecommunications Director to develop a system of equitable billings and charges for telecommunication service provided in any consolidated or joint-use system of telecommunications. Such system of charges shall reflect, as nearly as may be practical, the actual share of costs incurred on behalf of or for services to each department, agency, or political subdivision provided services from the state telexommunications system. Using agencies shall pay for such services out of appropriated or available funds. All payments shall be deposited in the Telecommunications Revolving Fund.

Section 10. There is hereby established a revolving fund to be known as the Telecommunications Revolving Fund. Appropriations made to the Executive Office for Administration and Finance for the purposes of this act shall be credited to the said revolving fund. All funds received under the provisions of this act, and all funds received for telecommunications services provided to any agency, department or other user shall be credited by the Bureau to such revolving fund. The Bureau shall, under policies and procedures established by the Commissioner of Administration and Finance, expend funds from time to time credited to the Telecommunications Revolving Fund for the telecommunications purposes enumerated in this act.

Section 11. In the event of an emergency, the Governor may direct civil defense assumption of control over all or part of the state telecommunications system.

Section 12. The Telecommunications Bureau is hereby authorized to receive gifts, contributions, property and equipment from public or private sources to be utilized in providing telecommunications services, and to participate with the federal government in carrying out programs for telecommunications services within the Commonwealth of Massachusetts. Whenever the federal government or any agency or officer thereof shall offer to the Commonwealth, or through the Commonwealth to any political subdivision thereof, telecommunications services, equipment, supplies, materials, or funds by way of gift, grant, or loan for purposes of state telecommunications system objectives, the Commonwealth, acting through the Governor, or such political subdivision, acting with the consent of the Governor and through its executive officer or governing body, may accept such offer and upon such acceptance the Governor or executive officer or governing body of such political subdivision may authorize any officer of the Commonwealth or such political subdivision to receive such services, equipment, supplies, materials, or funds on behalf of the Commonwealth or such political subdivision, and subject to the terms of the offer and rules and regulations, if any, of the agency making the offer.

Section 13. The state telecommunications system shall not be used for any purposes other than business of the Commonwealth or its political subdivisions except under conditions or functions of emergency.

Section 14. The state telecommunications system and the director shall not function as a public information or news agency. Communications transmitted on or through the state telecommunications system shall be the privileged information of the sender and receiver; Provided, that this shall not prohibit the sender or receiver from releasing to others or to the public such information; and provided further, that in the event of an emergency, the Governor shall have the power to direct release of such information as he deems in the best interests of the Commonwealth.

DIRECTOR
OF TELECOMMUNICATIONS

Interdepartmental liaison

State wide telecommunications planning

  Advice to State agencies, Departments and subdivisions of telecommunications

State wide telecommunications

  Policy recommendations

State representative on communication matters

Communications association

Memberships

Coordination with Educational Telecommunications Commission

Legal matters

Member of the Telecommunications Advisory Committee

Coordinate with data processing units regarding transmission of data

TELECOMMUNICATIONS SERVICES AND EQUIPMENT

Voice Communications and Switching Systems

- Studies for consolidate PBX and interlocation switching
- Consultation
- Compatibility matters
- New location telecommunications planning

Integration of facilities for use of voice, data or other electro-mechanical transmission

Consolidation and sharing of services for the mutual benefit of all agencies, departments and units of the Commonwealth.

- GSA control and allocation
- Development of technical specifications
- Evaluation of existing facilities
- Review and evaluation of new communications developments
- Establishments of standards
- Trend evaluation
- Supervision of operating personnel
- Training of operating personnel
- Education of communications users
- Develop program for continuity of service
    - * emergency communications
    - * security of communications
- Communications plan for emergency mobilization of employees
- Purchase lease and contract agreements covering acquisition and disposition of facilities
- Coordination with communications vendors

ETV - DATA-RADIO

ETV

- Coordinate with the Educational Communications Commission
  - * to establish most efficient interconnecting telecommunications systems for ETV broadcast service, 2500 MC ITFS and/or other ETV users
  - * jointly determine the quality of ETV service, hours of use and points to be interconnected
  - * determine data and other special educational telecommunications requirements
- Determine the most efficient method of service
- Develop specifications for construction or lease of service
- Provide for maintenance

DATA

- Representative to management
- Information Systems Committee(s)

Data Transport:

- Studies
- Estimates
- Coordination
- Integration

Teletypewriter Services
Other Non-Voice Telecommunications Services

RADIO

Provide liaison to all state government agencies and departments who use mobile radio service

- Develop a consolidated backbone network to reduce point-to-point radio transmission
- Investigate and develop other means of communication to reduce traffic on the radio networks
- Consolidate radio systems to develop greatest efficiency
- Operational control of systems should remain in user agencies
- Provide for maintenance
  * supervise state maintenance personnel
  * recommend maintenance contractors
  * provide quality control and inspection on all maintenance performed
- Develop operating routines
- Train maintenance people
- Educate radio users
- Radio frequency allocation and licensing
- Review and evaluation of new communications developments affecting ETV-Data and ETV

COMMUNICATIONS

ADMINISTRATION

Records

- Purchase orders
- Records of existing service
- Coordinate updating of State Telephone Directory
- Coordinate Telephone Company Directory listings
- Administer prorate of services to department
- Administer revolving fund
- Cost accounting and controls
- Process payroll

THE COMMONWEALTH OF MASSACHUSETTS

By His Excellency

JOHN A. VOLPE
Governor

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EXECUTIVE ORDER NO. 53

1. The purpose of this order is to establish the Massachusetts Emergency Communications Commission; to provide for the appointment of the members thereof; to set forth the functions of said Commission; and to implement the performance of such functions.

2. Pursuant to authority conferred upon me by Acts of 1950, Chapter 639, as amended, Section 4, to take all necessary preparatory steps in advance of actual disaster as may be deemed necessary, and pursuant to all other enabling authority, I, John A. Volpe, Governor of the Commonwealth, do hereby establish within the Massachusetts Civil Defense Agency the Massachusetts Emergency Communications Commission.

3. The members of the Commission shall be those persons hereafter appointed by the Governor upon recommendation of the Director of Civil Defense. Such persons so appointed shall serve at the pleasure of the Governor. The Chairman of the Commission shall be designated by the Governor to serve at the pleasure of the Governor.

4. The function of the Commission shall be to conduct a detailed survey and examination of the communications facilities and systems in Massachusetts and to provide plans which will integrate these resources into a capability providing flexibility and full use of all facilities as appropriate for any emergency purpose without interference with the primary function thereof. Such facilities and systems include: the national (civil defense) warning system; state and municipal warning

systems; state and municipal police radio systems, municipal fire department systems; communications systems of the Department of Public Works, Metropolitan District Commission and the Department of Natural Resources of the Commonwealth; industrial communications facilities including those of the New England Telephone Company, the Western Union, and utilities companies; aeronautical, marine and commercial broadcasting systems; and amateur radio facilities. The Commission shall also develop emergency mission assignments and develop state-wide emergency mission assignments and state-wide emergency communications command and control procedures.

5. Without limiting the generality of Section 4 of this Order, the Commission shall plan particularly with respect to the following aspects of emergency communications:

a. Warning: The expansion of emergency warning capabilities to include each municipality and individual in the Commonwealth.

b. Emergency Broadcast System: The development of an operational plan for public information to support the State Industry Advisory Committee on the Emergency Broadcast System appointed by the Federal Communications Commission.

c. Communications Resources Plan: The development of operational capabilities to execute the Plan by integrating organization and functions of other elements of emergency communications operations.

d. Command and Control: The development of emergency operational capabilities and procedures within the Commonwealth.

6. In carrying out its functions, the Commission shall make maximum practicable use of the services, equipment, supplies and facilities of existing departments, offices and agencies of the

Commonwealth and the political sub-divisions thereof and shall make maximum practicable use of the officers and personnel of all such departments, offices and agencies of the Commonwealth and of its political sub-divisions, and the officers and personnel of all such departments, offices and agencies are directed to cooperate with and extend such services to the Commission upon request.

7. The Director of Civil Defense for the Commonwealth is hereby authorized and directed to provide the Commission with such quarters, personnel, supplies and equipment, available to the Director, as may be necessary or appropriate and as may be made available, in the judgement of the Director, without interference with the existing functions of the Civil Defense Agency.

8. Any offer of the Federal Government or any agency or officer thereof, or any offer of any person, firm or corporation, to provide services, equipment, supplies, materials or funds, by way of gift, grant or loan, to or for the use of the Emergency Communications Commission, is hereby accepted and the Director of Civil Defense for the Commonwealth is authorized to receive such services, equipment, supplies, materials or funds, subject to the terms of the offer and the rules and regulations, if any, of the agency making the offer, and to make such services, equipment, supplies,materials or funds available to the Emergency Communications Commission.

Given at the Executive Chamber in Boston
this thirtieth day of December in the year
of our Lord one thousand nine hundred and
sixty-six and of the Independence of the
United State of America, the one hundred
and ninety-first.

JOHN A. VOLPE
Governor
Commonwealth of Massachusetts

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KEVIN H. WHITE
Secretary of the Commonwealth

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LEGISLATURE OF NEBRASKA

SEVENTY-SEVENTH SESSION

Legislative Bill 605

FINAL READING

Introduced by Harold B. Stryker, 23rd District; Jerome Warner, 25th District; George C. Gerdes, 49th District; J. James Waldron, 42nd District; Eric Rasmussen, 32nd District; Maurice A. Kremer, 34th District; Terry Carpenter, 48th District; Elvin Adamson, 43rd District; Rick Budd, 2nd District; Dale L. Payne, 3rd District; Roland A. Luedtke, 28th District; W. H. Hasebroock, 18th District; Leslie Robinson, 36th District; Rudolf C. Kokes, 41st District; Albert A. Kjar, 39th District; Bill K. Bloom, 20th District; Richard D. Marvel, 33rd District; William R. Skarda, Jr., 7th District; Calista Cooper Hughes, 1st District

Read first time January 27, 1967
Referred to Committee on Public Works
Sent to printer February 1, 1967
Final form sent to printer April 24, 1967

A BILL

FOR AN ACT relating to communications; to provide for a state telecommunications system as prescribed; and to declare an emergency.

Be it enacted by the people of the State of Nebraska, Section 1. The Legislature hereby declares that an efficient and reliable telecommunications system is vital to the security and welfare of the state during times of emergency and in the conduct of regular business of the state and that substantial economies can be effected by joint use of a consolidated telecommunications system by departments, agencies, and subdivisions of state government. It is, therefore, declared to be the purpose of this act and the policy of the state to provide for the development of an efficient and reliable telecommunications system for joint use by departments, agencies, and subdivisions of state government, to effect maximum practical consolidation and joint use of existing telecommunications facilities and services owned or used by the state, and generally to coordinate all telecommunications functions and activities of state government.

Sec. 2. As used in this act, unless the context otherwise requires:

(1) Board shall mean the State Telecommunications Board;

(2) Director shall mean the Telecommunications Director;

(3) Division shall mean the Telecommunications Division of the Department of Administrative Services;

(4) State Telecommunications System shall mean the total telecommunications facilities and equipment owned, leased, or used by all departments, agencies, and subdivisions of state government; and

(5) Telecommunication shall mean any transmission, emission, or reception of signs, signals, writing, images, and sounds or intelligence of any nature by wire, radio, optical, or other electromagnetic systems.

Sec. 3. There is hereby created, within the Department of Administrative Services, a telecommunications division to be headed by a Telecommunications Director. The Director of Administrative Services shall appoint as Telecommunications Director any person who has not less than three years' experience in a position or positions which include responsibility for management, purchase, lease, or control of telecommunications for a private or governmental enterprise. No person shall hold the position of Telecommunications Director who is directly or indirectly interested in any telecommunications common carrier or other company engaged in the furnishing of telecommunication services or facilities, but investment in stock of a telecommunications common carrier in an amount determined by the Director of Administrative Services to be not significant shall not be considered disqualifying.

Sec. 4. The director shall have the following duties, powers and responsibilities:

(1) To coordinate the purchase, lease, and use of telecommunications services for state government;

(2) To advise departments and agencies of the state and political subdivisions thereof as to systems or methods to be used to meet requirements efficiently and effectively;

(3) To consolidate the telecommunications systems and services of state agencies so far as practical and to provide for their joint use by the agencies;

(4) To assume management responsibility for any consolidated system or service;

(5) To enter into agreements for the mutual support and use of telecommunications services of the agencies and departments of state government and its political subdivisions;

(6) To provide for the rendering of mutual aid between state government and its political subdivisions and to cooperate with other states and the federal govern-

ment with respect to the organizing of telecommunications in expediting the carrying out of mutual aid in civil defense emergencies;

(7) To use or acquire telecommunications facilities now owned or operated by any state agency and to compensate such agency when appropriate;

(8) To standardize policies and procedures for the use of such services;

(9) To assume responsibility for the maintenance and repair of state-owned telecommunications facilities to far as practical;

(10) To coordinate and consolidate maintenance and repair procedures and facilities so far as possible in the light of good business practice and the requirements of the agencies and departments concerned;

(11) To contract with qualified suppliers and telecommunications common carriers for telecommunications facilities or services, including private line services;

(12) To apply for, receive, and hold, or, if appropriate, assist agencies in applying for, receiving, or holding such authorizations, licenses, and allocations of channels and frequencies as are necessary to carry out the purposes of this act;

(13) To acquire real estate, equipment, and other property as an agency of the state, subject to the provisions of section 6 of this act;

(14) To cooperate with the Civil Defense Agency as to its needs for emergency telecommunications services; and

(15) To insure that telecommunications facilities are not used for any purpose which is contrary to the policy and intent of this act or contrary to the laws and agreements under which the facilities are to be utilized.

Sec. 5. There is hereby established a State Telecommunications Board which shall consist of the Adjutant

General, the State Engineer, the chief officer of the Nebraska Safety Patrol, the secretary of the Game, Forestation and Parks Commission, the secretary of the Nebraska Educational Television Commission, the Director of Administrative Services, and the Director of Aeronautics. The board shall organize by electing one of its members as chairman, who shall serve for a period of one year and may succeed himself in this office if reelected by the board. It shall meet at least four times a year or upon call of the chairman, the Telecommunications Director, or any two members of the board. The board shall provide advice in the development, management, administration, and operation of a consolidated telecommunications system to meet the telecommunications requirements of all departments and agencies of state government. Board members shall receive no compensation for duties performed as members of the board, but shall be reimbursed for actual expenses incurred while engaged in the performance of their duties under the provisions of this act.

Sec. 6. The division shall have authority to purchase or lease telecommunications facilities, services, or channels on terms which are for the best interests of the State of Nebraska. In making the decision as to what proposal is for the best interests of the state, the decision of the division shall be based upon, but not necessarily limited to, (1) the total cost to the state, computed in accordance with accepted governmental costs accounting procedures, taking into account taxes to be paid or foregone, interest rates, and obsolescence; (2) the quality of the service offered; (3) the comprehensiveness of the proposed facilities or plan; (4) the financial responsibility of the supplier or carrier submitting the proposal; (5) the repair and maintenance capabilities of the supplier or carrier; (6) the experience as a telecmmunications carrier or supplier, as applicable; and(7) the alternate methods or facilities available.

Sec. 7. Personnel of all departments, offices, and agencies of state government shall cooperate and assist to the maximum extent possible in the consolidation and joint use of telecommunications systems and services used by and under the direction of such departments or agencies.

Sec. 8. The Telecommunicaions Director shall develop a system of equitable billings and charges for telecommunication services provided in any consolidated or joint-use system of telecommunications. Such system of charges shall reflect, as nearly as may be practical, the actual share of costs incurred on behalf of or for services to each department, agency, or political subdivision provided services from the state telecommunications system. Using agencies shall pay for such services out of appropriated or available funds. All payments shall be deposited in the Telecommunications Revolving Fund.

Sec. 9. There is hereby established a revolving fund to be known as the Telecommunications Revolving Fund. Appropriations made to the Department of Administrative Services for the purposes of this act shall be credited to the revolving fund. All funds received under the provisions of this act, and all funds received for telecommunications services provided to any agency, department or other user shall be credited by the division to such revolving fund. The division shall, under policies and procedures established by the director, expend funds from time to time credited to the Telecommunications Revolving Fund for the telecommunications purposes enumerated in this act.

Sec. 10. This act shall not apply to the Nebraska educational television network except for such services or assistance as may be mutually beneficial and agreed upon by and between the telecommunications division and the Nebraska Educational Television Commission. Under conditions of emergency declared by the Governor, the communications resources of the Nebraska educational television network shall be coordinated with the state telecommunications system, as directed by the Governor, so as to provide full use of available services in the rendering of public assistance and providing aid and protection to life and property.

Sec. 11. In the event of an emergency, the Governor may direct civil defense assumpton of control over all or part of the state telecommunications system.

Sec. 12. The Telecommunications Director is hereby authorized to receive gifts, contributions, property and equipment from public or private sources to be utilized in providing telecommunications services, and to participate with the federal government in carrying out programs for telecommunications services within the State of Nebraska. Whenever the federal government or any agency or officer thereof shall offer to the state, or through the state to any political subdivision thereof, telecommunications services, equipment, supplies, materials, or funds by way of gift, grant, or loan for purposes of state telecommunications system objectives, the state, acting through the Governor, or such political subdivision, acting with the consent of the Governor and through its executive officer or governing body, may accept such offer and upon such acceptance the Governor or executive officer or governing body of such political subdivision may authorize any officer of the state or such political subdivision to receive such services, equipment, supplies, materials, or funds on behalf of the state or such political subdivision, and subject to the terms of the offer and rules and regulations, if any, of the agency making the offer.

Sec. 13. The state telecommunications system shall not be used for any purposes other than business of the state or its political subdividions except under conditions of emergency.

Sec. 14. The state telecommunications system and the director shall not function as a upblic information or news agency. Communications transmitted on or through the state telecommunications system shall be the privileged information of the sender and receiver; *Provided,* that this shall not prohibit the sender or receiver from releasing to others or to the public such information; *and provided further,* that in the event of an emergency, the Governor shall have the power to direct release of such information as he deems in the best interests of the state.

Sec. 15. Since an emergency exists, this act shall be in full force and take effect, from and after its passage and approval, according to law.

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HOUSE REPRINT

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THE GENERAL ASSEMBLY OF PENNSYLVANIA

SENATE BILL

No. 1685

Session of 1968

INTRODUCED BY MESSRS. McGREGOR, FRAME AND KLINE, JUNE 24, 1968

AS AMENDED ON SECOND CONSIDERATION, HOUSE OF REPRESENTATIVES, JULY 16, 1968

AN ACT

Providing for the growth and development of noncommercial educational television; creating the Pennsylvania Public Television Network Commission as an independent commission and defining its powers and duties.

The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows:

Section 1. Declaration of Public Policy.—The General Assembly hereby declares that it is in the public interest of the Commonwealth to encourage and develop the growth of noncommercial educational television broadcasting, including the use of such media for instructional purposes; that the expansion and development of noncommercial educational television broadcasting and its programming diversity depend on freedom, imagination and initiative; that it furthers the general welfare to encourage such programming which will be responsive to the interests of people throughout the Commonwealth and which will constitute an expression of diversity and excellence; that it is necessary and appropriate for the State government to complement, assist and support a policy that will most effectively make noncommercial educational tele-

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vision service available to the people of the Commonwealth; and that an independent commission should be created to facilitate the development of educational television broadcasting and to afford maximum protection from extraneous interference and control.

Section 2. Creation of Commission.—There is hereby created the Pennsylvania Public Television Network Commission, hereinafter referred to as "commission", as an independent commission with powers to encourage the growth and development of noncommercial television broadcasting and programming. Such commission shall consist of ~~thirteen~~ TWENTY-TWO commissioners, who shall be appointed or designated as follows: The Governor shall appoint ~~eight~~ SIX members, by and with the advice and consent of the Senate for a term of six years ~~one of whom shall be a representative of private education; one of whom shall be a representative of public education; one of whom shall be a member of one of the regional broadcasting councils within the Commonwealth; one of whom shall be a station manager of a noncommercial television station within the Commonwealth; and four of whom,~~ WHO shall be selected so as to provide a broad representation as nearly as practicable, of various professions and occupations and various kinds of talent and experience appropriate to the functions and responsibilities of the commission. ~~Of the members just appointed by the Governor, two shall be appointed for a term of two years, three shall be appointed for a term of four years and three shall be appointed for a term of six years. Thereafter, all terms shall be six years, except that an appointment to fill a vacancy shall be for the unexpired term.~~ THE GOVERNOR SHALL ALSO APPOINT A REPRESENTATIVE OF PRIVATE EDUCATION AND A REPRESENTATIVE OF PUBLIC EDUCATION AND SHALL DESIGNATE THE CHAIRMAN OF THE COMMISSION.

THE FOLLOWING SHALL BE EX OFFICIO MEMBERS OF THE COMMISSION: THE SUPERINTENDENT OF PUBLIC INSTRUCTION OR HIS NOMINEE; THE CHAIRMAN OF THE PENNSYLVANIA COUNCIL ON THE ARTS; THE CHAIRMAN OF THE NETWORK OPERATIONS COMMITTEE; AND A MEMBER FROM EACH OF THE SEVEN GOVERNING BOARDS OF PUBLIC TELEVISION STATION LICENSEES SERVING THE COMMONWEALTH.

The President Pro Tempore of the Senate ~~and~~, THE MINORITY LEADER OF THE SENATE, the Speaker of the House AND THE MINORITY LEADER OF THE HOUSE shall each appoint ~~two members~~ ONE MEMBER of their respective Chambers and insure that there is majority and minority party representation.

~~The Superintendent of Public Instruction or his nominee shall also be a member. The board shall select from their number, annually, a chairman. Seven members of the board shall constitute a quorum and all members shall have the right to vote on all matters.~~

Such commissioners shall receive no salary but shall be reimbursed for expenses incurred in the performance of their official duties. The commission shall appoint such deputies, secretaries, officers as it may deem necessary, and shall perform all things necessary and proper, consistent with the powers and duties imposed upon it by this act.

Such commission shall, annually, make a full report to the Governor and the General Assembly as soon as possible after the close of each fiscal year, and make such other reports at such intervals as it deems necessary and advisable.

~~Section 3. Duties of Superintendent of Public Instruction. It shall be the duty of the Superintendent of Public Instruction to provide any necessary personnel from the Department of Public Instruction to per-~~

~~form staff functions for the commission. The Superintendent of Public Instruction is authorized to transfer any library, archives, films or other materials relating to educational television in his custody to the commission.~~

Section ~~4.~~ 3. Powers and duties of the Pennsylvania Public Television Network Commission.—The powers and duties of the commission shall include, but not be limited to, the following:

(1) To assist, develop and support a statewide policy to encourage the growth and development of a dynamic, free and effective public television service;

(2) To make grants to public television stations serving Pennsylvania to aid in the improvement of their broadcast operations, programming, and capital facilities;

(3) To establish and develop and operate, on behalf of the Commonwealth, a public television network system interconnecting all noncommercial television stations serving Pennsylvania;

(4) To insure the diversity of programming to allow for freedom, imagination, objectivity and initiative on both the State and local level and to insure that the networks shall not be misused for political or other propaganda purposes contrary to the Federal Constitution or the Constitution of the Commonwealth of Pennsylvania.

(5) To apply for, receive and distribute Federal funds, State funds and public or private funds from any source whatsoever, and to serve as a coordination agency in connection with those funds which are available through the Federal Public Broadcasting Act of 1967 and other Federal legislation now or hereinafter enacted;

(6) To enter into contracts, leases and other arrangements to own and operate interconnection and switching facilities and equipment pertinent to a statewide network and to apply to the Federal Communica-

tions Commission and other Federal agencies for such licenses necessary to operate and maintain such a network;

(7) To contract with or make plans with other agencies or individuals to program productions and otherwise to procure educational and public television programs for distribution to the noncommercial educational television network;

(8) To conduct research, demonstration and training activities in matters relating to noncommercial educational and public television broadcasting;

(9) To establish and maintain a library and archives for programs and related materials and to develop and promote public awareness of and disseminate information concerning noncommercial educational and public television; and

(10) To do all things necessary and proper to effectuate the provisions of this act which are not inconsistent with law, and to promulgate rules and regulations relative thereto.

SECTION 4. CONTRACTS.—ALL CONTRACTS OR PURCHASES MADE BY THE COMMISSION INVOLVING THE EXPENDITURE OF OVER ONE THOUSAND FIVE HUNDRED DOLLARS ($1,500), EXCEPT THOSE INVOLVING PERSONAL SERVICES OR ITEMS THAT CAN ONLY BE OBTAINED FROM ONE SOURCE, SHALL BE IN WRITING, AWARDED ON THE BASIS OF COMPETITIVE BIDDING AND SHALL BE MADE ONLY AFTER NOTICE OF THE PROPOSED CONTRACT OR PURCHASE IS PUBLISHED IN AT LEAST TWELVE NEWSPAPERS, AS THE COMMISSION SHALL DETERMINE WILL BE SUFFICIENT TO ENSURE DISTRIBUTION OF THE NOTICE THROUGHOUT THE COMMONWEALTH, AT LEAST TWENTY

DAYS BEFORE THE LETTING OF THE CONTRACT OR PURCHASE.

~~Section 5. Repeals.—All acts and parts of acts are repealed in so far as they are inconsistent herewith.~~

Section ~~6.~~ ~~4.~~ 5. Effective Date.—This act shall take effect ~~January 1, 1969.~~ IMMEDIATELY.

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APPROPRIATIONS ACT OF 1960

SECTION 9

A. There is hereby created the South Carolina Educational Television Commission which shall be composed of the Chairman of the Senate Finance Committee, the Chairman of the Senate Education Committee, the Chairman of the Ways and Means Committee of the House, the Chairman of the Education Committee of the House and the Superintendent of Education, who shall be members of the Commission, ex officio, and in addition to the foregoing members the Commission shall be composed of seven members to be appointed by the Governor as follows: one shall be appointed from each of the six Congressional Districts, and one shall be appointed from the State at large who shall be named by the Governor as Chairman of the Commission. The terms of the members who serve ex officio shall be coterminous with the terms of the offices to which they were elected, and the terms of the members appointed by the Governor shall serve for six years, except that of those first appointed two shall serve for terms of two years, two shall be for terms of four years and three shall serve for terms of six years, after which the terms of all members shall serve for six years.

B. The Commission shall appoint an advisory committee of educators and an advisory committee of technical experts, each of which shall consist of such numbers as the Commission may deem advisable, and the terms of the members of the committee of educators and committee of technical experts shall be for such length and under such conditions as the Commission may decide.

The members of the Commission and each of the advisory committees shall receive such per diem and mileage as authorized by law for other boards and commissions of the State.

C. The Commission shall make a complete study of the use of educational television and its adaptation for instructional purposes in all of the public schools of the State. The State Department of Education and any other State Agency shall render such assistance, advice and cooperation as may be within their means upon the request of the Commission. The Commission shall make such report with recommendations as may be desirable to the Governor and the General Assembly from time to time.

D. The Commission shall have the power to accept contributions from all persons, firms, and corporations who may wish to contribute to the program, provided, that both the acceptance and use of any such contributions shall be subject to express approval by the State Budget and Control Board.

APPENDIX B

COST ASSUMPTION AND VALIDITY TESTS

COST ASSUMPTION AND VALIDITY TESTS

Microwave Costs

Costs for the State-owned or leased alternatives are based on standard estimating figures widely used in the industry. The equipment costs must be considered somewhat high as they represent the manufacturer's catalog list price. In competitive bidding on a system of the magnitude of the systems presented, the competitors can be expected to submit bids that are less than list.

Land

This figure is based on the minimum size plot of land that will accommodate a facilities building and a 300-foot tower having 45° guy wires. Exact land size will vary depending on availability but could range from 3.5 to 5 acres. Average land costs are assumed to range between $200 and $500 per acre for the type of land required.

Average Land Cost:	$ 1,000

Building and Tower

Based on figures furnished by the Nebraska Consolidated Communications Corporation (NCCC) and substantiated by General Electric Company and Lenkurt, the nonelectric facility costs are:

Building with heat and air conditioning	$ 7,500
300-foot Tower	8,000
Standby Power	6,000
Alarms	1,000
TOTAL:	$22,500

Antenna Costs

Based on industry figures (G.E., Andrews, etc.)

10-foot x 15-foot Reflector	$ 500
10-foot Dish with Mount	1,500
TOTAL:	$ 2,000

Broadband Microwave Radio System

TV Channel Equipment

Demodulating Repeater - Lenkurt 76E	
One Channel - 1 way	$ 7,750
One Channel - 2 way	14,450
Demodulating Terminal - Lenkurt 76E	
Transmit Only	5,000
Receive Only	5,500

Voice Channel Equipment

Demodulating Terminal - Lenkurt 76E	
One Channel - 2 way	$ 7,750
Demodulating Repeater - Lenkurt 76E	
One Channel - 2 way	15,200

Multiplexers

Costs based on Lenkurt 46A2 Multiplex System and the Lenkurt 927A In-Band Signaling System. Costs are variable depending on number of channels terminated

Voice Channel Termination Costs

A microwave system requires one hybrid circuit per channel at each terminal to convert to 2-wire operation for interface with a normal telephone system.

Cost of conversion is $92 per channel terminal.

Installation and Contingency Costs

Twenty percent of electronic equipment costs. Industry pricing estimates range from 15 percent to 20 percent for this category. The top of the range was used to assure a safe margin.

Accessory and Spares Costs

a. Assumes that there will be three major maintenance centers or depots that will carry a substantial stock of spares and test equipment. These will be located in
    - Chicago
    - Springfield
    - Carbondale

   Cost of accessories and spares for these three locations is assumed to be 15 percent of equipment costs.

b. All other terminals will have accessories and spares equal to 5 percent of equipment costs.

System Life

Fifteen years was chosen as a reasonable system life rather than the more traditional ten years because of advice from manufacturers and because of Nebraska's procurement experience. The recent improvements in microwave and multiplexing solid-state circuitry promise better reliability and resistance to obsolescence than was possible only a few years ago.

In Nebraska's contract for a microwave network, 15 years was used as system life for total price comparison in competing with the common carrier.

Cost of Money

Five percent of the system purchase and installation cost.

If the State builds its own microwave system, it must consider the cost of money for the capital expenditures just as a vendor to the State would have to do. Illinois State Treasurer, Adlai Stevenson III, advised SDC that he estimates that the State would actually incur a cost of 4.823 percent on a capital expense of this size and type. Five percent is used in the costings for this study for ease in calculation and to be consistent with similar studies. All purchase and installation costs are assumed to be paid the year they are installed, and their total is then amortized over the balance of 15-year system life. Any salvage value is assumed to be negligible.

Maintenance

Ten percent per year of equipment costs.

This is one of the most difficult items of cost to estimate for the proposed systems. While there has been considerable industry experience in maintaining private microwave networks, the industry averages can only be used in a very general way. Three factors prevent their being applied here.

First, the industry figures vary widely because of the route structures, weather, etc. A widely quoted study performed by A. D. Little [12] for American Telephone and Telegraph shows that the average annual maintenance cost is approximately $175 per route mile. But, in the system they studied, individual costs ran from $100 to $250 per mile--a fairly wide spread.

Hamsher's Communication System Engineering Handbook [13] reports on 18 systems with an average maintenance cost closer to $100 per route mile with a spread from $43 to $400.

Second, these figures are for systems a small fraction of the size proposed for Illinois. The average number of stations is quite small compared to the 70 in the combined ETV and Administrative Network and the number of video and voice-grade channels will be by far the highest in the country. Maintenance cost should vary roughly as the capacity of the system varies so no comparison is possible.

Third, there is very little field experience on 12 GHz networks. Failure rates and cost per repair should be roughly the same as the widely used 6 GHz equipment, but the amount of equipment in the system is higher. A 12 GHz system is limited to about 20-mile hops, but the hops in a 6 GHz system are often 50 miles long and some even go 70 miles between stations.

In Illinois, it will take 70 stations at 12 GHz to cover the same number of route miles that would have taken 33 stations at 6 GHz. Again, maintenance cost should vary roughly as the amount of equipment in the system so the 12 GHz costs should be much higher.

Instead of using these misleading industry averages, an operating system that most nearly corresponds to the proposed ones was used as guidance for estimating the costs of the alternatives for Illinois. The system in Nebraska will be about 1,900 route miles as opposed to 1,500 for Illinois and, also, the Nebraska system has a large number of voice and data channels. It does not have any video channels and is at 6 GHz instead of 12 GHz, but instead has an elaborate switching system and other features that make it comparable in complexity and equipment "count" to Illinois.

This system is being maintained by an outside contractor, the Nebraska Consolidated Communications Corporation (NCCC), as part of their overall lease-purchase contract with the State. NCCC used 10 percent of the equipment acquisition cost as a projected maintenance figure in their fixed-price competitive bid for the contract. So far, NCCC believes that the figure is a realistic one and will cover their actual costs.

We believe that Nebraska's experience is the best guidance that Illinois can use in this case, so we have used 10 percent of the equipment acquisition cost in projecting the costs of all State-owned alternatives.

Lost Taxes

Two and one-half percent per year of total system purchase and installation costs.

If the State were to buy its own system, it would have to forego normal State taxes that would be paid by someone else--either the common carrier or a third party--who supplied the service to the State. The percentage is applied each year to the depreciated system value for that year. Based on the amortized value for a 15-year life it becomes 21.2 percent of the purchase price. This is then added to the annual cost at 1/15 of the lump sum per year.

Local Leased Lines

If the State owns a microwave system, it must connect to the standard telephone system if it is to give full use for voice and data traffic. Each message channel must have a connection between the microwave station where it terminates and the nearest telephone switchboard. A minimum one-mile leased line charge is assumed and each interconnection point has been costed under the lowest tariff that applies to it.

These basic cost inputs for the State-owned system are the essential ingredients used in preparing the cost-effectiveness analyses performed for all the noncommon carrier combinations of the microwave systems. Each voice and data system is costed individually for both P-1 and P-10 grades of service, and comprehensive cost work-ups are furnished. Costing logic is also explained in detail.

Leased System Costs

An interesting alternative method of financing--one not covered by the Statement of Work--emerged during this study. There is now precedent for third-party financing of a large statewide system by a noncommon carrier.

Costs for leasing a system from a noncommon carrier are based on the experience of the State of Nebraska. The NCCC contracted to build the State a telecommunications network--based on the use of microwave--to be paid for by the State on an annual lease fee. NCCC is a noncommon carrier formed by independent telephone companies of Nebraska for this purpose. All capital costs, taxes, finance charges, spare parts, and maintenance are to be paid by NCCC out of the lease income.

The rate used to determine the lease fee in Nebraska was 22 percent per year of the firm fixed price bid for the installed cost of the network. Any similar contract with Illinois would have to be negotiated between the principals involved and the 22 percent annual fee cannot be guaranteed, but the 22 percent figure is representative and was used in the costing for the leased systems.

Sensitivity Analysis of the Cost Assumptions Used

A routine step in cost effectiveness analysis is to determine if the calculated totals are sensitive to small changes in the input assumptions used. That is, to see if a small error in estimating a factor (such as the maintenance cost) would cause a large change in the total projected costs. If a small change in an input estimate does cause a large change in the output total, the analysts must refine the estimate as much as possible and then caution the reader as to what effect an error would have. If it does not cause a large change, more confidence can be placed in the totals because the sensitivity analysis has shown that, even if an error has been made in estimating a cost factor, it does not significantly affect the results.

This technique does not imply that the individual cost estimates are actually in error; it merely tests to see if a possible error is important or not.

The usual method employed in a sensitivity analysis is to recalculate the total costs with the input estimates increased and decreased by an arbitrary percentage, or by using new estimates representing the highest and lowest extremes to which the factors might be reasonably expected to be in error. The key estimates used in this study were:

- A system life of 15 years
- An interest rate of 5 percent
- A maintenance cost of 10 percent per year of the initial equipment costs, and

- a "lost taxes" cost of 2.5 percent per year of the initial equipment costs amortized over the 15-year system lifetime

The projected annual costs of one of the alternatives discussed--the State-owned Administrative Network--were recalculated for:

Lifetimes of 10 and 20 years (representing a ±33 percent error)

Interest rates of 4.5 percent and 4.75 percent (representing a 10 percent and 5 percent error)

Maintenance costs of 8 percent and 12 percent (representing a ± 20 percent error), and

Lost taxes of 2 percent and 3 percent (representing a ± 20 percent error)

Table B-1 presents the results using the original and the new trial estimates. The sensitivity analysis showed that:

- Changing System Life from 15 years to 10 or 20 years (keeping all other values the same) changes the annual cost + 15% or -7%, respectively.
- Changing Cost of Money from 5% to 4.5% (keeping all other values the same) changes the annual cost - 1.2%.
- Changing Maintenance Cost from 10% to 8% or 12% (keeping all other values the same) changes the annual cost ± 8%.
- Changing Lost Taxes from 2.5% to 2% or 3% (keeping all other values the same) changes the annual cost ± 2%.

These differences in projected costs are not considered to be significant since they are no larger than the errors possible from other sources such as the projections of growth rates and equipment price differences in a competitive procurement.

Table B-1

Effect of Arbitrary Changes in the Estimating factors

	SYSTEM LIFE OF 10 YEARS		SYSTEM LIFE OF 15 YEARS		SYSTEM LIFE OF 20 YEARS	
	P-1	P-10	P-1	P-10	P-1	P-10
Total Interest Costs for System Life:						
4.5%	$1,436,270	$1,310,401	$2,157,940	$1,968,828	$2,924,767	$2,668,452
4.75%	1,523,316	1,389,819	2,289,327	2,088,700	3,107,565	2,835,232
(used in study) 5.0%	1,604,922	1,464,274	2,421,535	2,209,315	3,286,005	2,998,040
Total Maintenance Costs for System Life:						
8.0%	$4,352,332	$3,970,912	$6,528,498	$5,956,368	$ 8,704,664	$ 7,941,824
(used in study) 10.0%	5,440,415	4,963,640	8,160,630	7,445,460	10,880,840	9,927,280
12.0%	6,528,498	5,956,368	9,792,747	8,934,552	13,056,996	11,912,736
Total Cost of Lost Taxes for System Life:						
2.0%	$1,088,083	$ 992,728	$1,632,125	$1,489,092	$2,176,166	$1,985,456
(used in study) 2.5%	1,360,104	1,240,910	2,040,150	1,861,365	2,720,207	2,481,820
3.0%	1,632,125	1,489,092	2,448,188	2,233,638	3,264,250	2,978,184

The conclusion that may be drawn from the analysis is that the relative ranking of the annual costs of the various approaches will not be changed by small errors in the estimating factors used for the cost projections.

APPENDIX C

ESTIMATED COSTS OF UHF STATIONS

ESTIMATED COST OF UHF STATION
CARBONDALE (GOREVILLE)

Quantity	Equipment	Cost
1	30-kilowatt UHF transmitter, including sideband filter, diplexer, and harmonic filters	$200,000
1 set	Spare tubes	11,000
1	Transmitter control console, including master monitor	7,000
1 set	Transmitter input and monitoring equipment	25,000
1	Guyed 1000-foot antenna supporting tower	120,000
1	Antenna, 25 gain, with lightning protector and deicing	47,500
1	RF load and wattmeter	3,700
1200 ft.	6-1/8 inch transmission line (including hangers, elbows, etc.)	72,000
1	Line pressurizing equipment	1,740
Misc.	Fixed hangers, adaptors, inside fittings, hardware kits, clamps, connectors, valves, and gassing accessories	3,000
1 set	Test equipment	7,800
1	Video tape recorder with accessories	70,000
1	Vidicon film camera	50,000
1	Slide projector	3,500
1	Audio tape recorder	1,500
1	Sync generator	6,500
Misc.	Racks, monitors, and panels	6,500
	Land (40 acres)	40,000
	Building, site improvement	30,000
	Furniture and fixtures	5,000
	Installation	20,000
	Legal and engineering	10,000
	Freight and contingencies	40,000
	TOTAL:	$781,740

ESTIMATED COST OF UHF STATION
DE KALB

Quantity	Equipment	Cost
1	15-kilowatt transmitter, including sideband filter, diplexer, and harmonic filters	$175,000
1 set	Spare tubes	8,000
1	Transmitter control console, including master monitor	7,000
1 set	Transmitter input and monitoring equipment	25,000
1	Guyed 600-foot antenna supporting tower	65,000
1	Antenna, 25 gain, with deicing and lightning protection	47,500
1	RF load and wattmeter	3,700
700 ft	6-1/8 inch transmission line (including hangers, elbows, etc.)	42,000
1	Line pressurizing equipment	1,740
Misc.	Fixed hangers, adaptors, inside fittings, hardware kits, clamps, connectors, valves, and gassing accessories	3,000
1 set	Test equipment	7,800
1	Video tape recorder with accessories	70,000
1	Vidicon film camera	50,000
1	Slide projector	3.500
1	Audio tape recorder	1,500
1	Sync generator	6,500
Misc.	Racks, monitors, and panels	6,500
	Land (25 acres)	25,000
	Building, site improvement	30,000
	Furniture and fixtures	5,000
	Installation	20,000
	Legal and engineering	10,000
	Freight and contingencies	30,000
	TOTAL:	$643,740

ESTIMATED COST OF UHF STATION
EDWARDSVILLE (CARLINVILLE)

Quantity	Equipment	Cost
1	50-kilowatt transmitter, UHF including sideband filter, diplexer and harmonic filters	$298,000
1 set	Spare tubes	15,000
1	Transmitter control console, including master monitor	7,500
1 set	Transmitter input and monitoring equipment	25,000
1	Guyed antenna supporting tower, 1000-foot	120,000
1	Antenna, 25 gain, with deicing and lightning protection	47,500
1	RF load and wattmeter	3,700
1200 ft	6-1/8 inch transmission line (including hangers, elbows, etc.)	72,000
1	Line dehydrator equipment	1,740
Misc.	Fixed hangers, adaptors, inside fittings, hardware kits, clamps, connectors, valves, and related accessories	5,200
1 set	Test equipment	10,000
1	Video tape recorder with accessories	70,000
1	Vidicon film camera	50,000
1	Slide projector	3,500
1	Audio tape recorder	1,500
1	Sync generator	6,500
Misc.	Racks, monitors, and panels	6,500
	Land (40 acres)	40,000
	Building, site improvement	50,000
	Furniture and fixtures	5,000
	Installation	20,000
	Legal and engineering	10,000
	Freight and contingencies	50,000
	TOTAL:	$918,640

ESTIMATED COST OF UHF STATION
FREEPORT

Quantity	Equipment	Cost
1	15-kilowatt UHF transmitter, including sideband filter, diplexer, and harmonic filters	$175,000
1 set	Spare tubes	8,000
1	Transmitter control console, including master monitor	7,000
1 set	Transmitter input and monitoring equipment	25,000
1	Guyed 600-foot antenna supporting tower	65,000
1	Antenna, 25 gain, with deicing and lightning protection	47,500
1	RF load and wattmeter	3,700
700 ft	6-1/8 inch transmission line (including hangers, elbows, etc.)	42,000
1	Line pressurizing equipment	1,740
Misc.	Fixed hangers, adaptors, inside fittings, hardware kits, clamps, connectors, valves, and gassing accessories	3,000
1 set	Test equipment	7,800
1	Video tape recorder with accessories	70,000
1	Vidicon film camera	50,000
1	Slide projector	3,500
1	Audio tape recorder	1,500
1	Sync generator	6,500
Misc.	Racks, monitors, and panels	6,500
	Land (25 acres)	25,000
	Building, site improvement	30,000
	Furniture and fixtures	5,000
	Installation	20,000
	Legal and engineering	10,000
	Freight and contingencies	30,000
	TOTAL:	$643,740

ESTIMATED COST OF UHF STATION
KANKAKEE

Quantity	Equipment	Cost
1	15-kilowatt UHF transmitter, including sideband filter, diplexer, and harmonic filters	$175,000
1 set	Spare tubes	8,000
1	Transmitter control console, including master monitor	7,000
1 set	Transmitter input and monitoring equipment	25,000
1	Guyed 600-foot antenna supporting tower	65,000
1	Antenna, 25 gain, with deicing and lightning protection	47,500
1	RF load and wattmeter	3,700
700 ft	6-1/8 inch transmission line (including hangers, elbows, etc.)	42,000
1	Line pressurizing equipment	1,740
Misc.	Fixed hangers, adaptors, inside fittings, hardware kits, clamps, connectors, valves, and gassing accessories	3,000
1 set	Test equipment	7,800
1	Video tape recorder with accessories	70,000
1	Vidicon film camera	50,000
1	Slide projector	3,500
1	Audio tape recorder	1,500
1	Sync generator	6,500
Misc.	Racks, monitors, and panels	6,500
	Land (25 acres)	25,000
	Building, site improvement	30,000
	Furniture and fixtures	5,000
	Installation	20,000
	Legal and engineering	10,000
	Freight and contingencies	30,000
		$643,740

ESTIMATED COST OF UHF STATION
MACOMB

Quantity	Equipment	Cost
1	30-kilowatt UHF transmitter, including sideband filter, diplexer, and harmonic filters	$200,000
1 set	Spare tubes	11,000
1	Transmitter control console, including master monitor	7,000
1 set	Transmitter input and monitoring equipment	25,000
1	Guyed 1000-foot antenna supporting tower	120,000
1	Antenna, 25 gain, with lightning protector and deicing	47,500
1	RF load and wattmeter	3,700
1200 ft.	6-1/8 inch transmission line (including hangers, elbows, etc.)	72,000
1	Line pressurizing equipment	1,740
Misc.	Fixed hangers, adaptors, inside fittings, hardware kits, clamps, connectors, valves, and gassing accessories	3,000
1 set	Test equipment	7,800
1	Video tape recorder with accessories	70,000
1	Vidicon film camera	50,000
1	Slide projector	3,500
1	Audio tape recorder	1,500
1	Sync generator	6,500
Misc.	Racks, monitors, and panels	6,500
	Land (40 acres)	40,000
	Building, site improvement	30,000
	Furniture and fixtures	5,000
	Installation	20,000
	Legal and engineering	10,000
	Freight and contingencies	40,000
	TOTAL:	$781,740

ESTIMATED COST OF UHF STATION
PEORIA

Quantity	Equipment	Cost
1	15-kilowatt UHF transmitter, including sideband filter, diplexer, and harmonic filters	$175,000
1 set	Spare tubes	8,000
1	Transmitter control console, including master monitor	7,000
1 set	Transmitter input and monitoring equipment	25,000
1	Guyed 600-foot antenna supporting tower	65,000
1	Antenna, 25 gain, with deicing and lightning protection	47.500
1	RF load and wattmeter	3,700
700 ft.	6-1/8 inch transmission line (including hangers, elbows, etc.	42,000
1	Line pressurizing	1,740
Misc.	Fixed hangers, adaptors, inside fittings, hardware kits, clamps, connectors, valves, and gassing accessories	3,000
1 set	Test equipment	7,800
1	Video tape recorder with accessories	70,000
1	Vidicon film camera	50,000
1	Slide projector	3,500
1	Audio tape recorder	1,500
1	Sync generator	6,500
Misc.	Racks, monitors, and panels	6,500
	Land (25 acres)	25,000
	Building, site improvement	30,000
	Furniture and fixtures	5,000
	Installation	20,000
	Legal and engineering	10,000
	Freight and contingencies	30,000
	TOTAL:	$643,740

ESTIMATED COST OF UHF STATION
QUINCY

Quantity	Equipment	Cost
1	15-kilowatt UHF transmitter, including sideband filter, diplexer, and harmonic filters	$175,000
1 set	Spare tubes	8,000
1	Transmitter control console, including master monitor	7,000
1 set	Transmitter input and monitoring equipment	25,000
1	Guyed 300-foot antenna supporting tower	65,000
1	Antenna, 25 gain, with lightning protector and deicing	47,500
1	RF load and wattmeter	3,700
700 ft.	6-1/8 inch transmission line (including hangers, elbows, etc.)	42,000
1	Line pressurizing equipment	1,740
Misc.	Fixed hangers, adaptors, inside fittings, hardware kits, clamps, connectors, valves, and gassing accessories	3,000
1 set	Test equipment	7,800
1	Video tape recorder with accessories	70,000
1	Vidicon film camera	50,000
1	Slide projector	3,500
1	Audio tape recorder	1,500
1	Sync generator	6,500
Misc.	Racks, monitors, and panels	6,500
	Land (25 acres)	25,000
	Building, site improvement	30,000
	Furniture and fixtures	5,000
	Installation	20,000
	Legal and engineering	10,000
	Freight and contingencies	30,000
	TOTAL:	$643,740

ESTIMATED COST OF UHF STATION
ROCK ISLAND - MOLINE

Quantity	Equipment	Cost
1	30-kilowatt UHF transmitter, including sideband filter, diplexer, and harmonic filters	$200,000
1 set	Spare tubes	11,000
1	Transmitter control console, including master monitor	7,000
1 set	Transmitter input and monitoring equipment	25,000
1	Guyed 600-foot antenna supporting tower	65,000
1	Antenna, 25 gain, with lightning protector and deicing	47,500
1	RF load and wattmeter	3,700
700 ft.	6-1/8 inch transmission line (including hangers, elbows, etc.)	42,000
1	Line pressurizing equipment	1,740
Misc.	Fixed hangers, adaptors, inside fittings, hardware kits, clamps, connectors, valves, and gassing accessories	3,000
1 set	Test equipment	7,800
1	Video tape recorder with accessories	70,000
1	Vidicon film camera	50,000
1	Slide projector	3,500
1	Audio tape recorder	1,500
1	Sync generator	6,500
Misc.	Racks, monitors, and panels	6,500
	Land (25 acres)	25,000
	Building, site improvement	30,000
	Furniture and fixtures	5,000
	Installation	20,000
	Legal and engineering	10,000
	Freight and contingencies	30,000
	TOTAL:	$671,740

ESTIMATED COST OF UHF STATION
SPRINGFIELD

Quantity	Equipment	Cost
1	15-kilowatt UHF transmitter, including sideband filter, diplexer, and harmonic filters	$175,000
1 set	Spare tubes	8,000
1	Transmitter control console, including master monitor	7,000
1 set	Transmitter input and monitoring equipment	25,000
1	Guyed 600-foot antenna supporting tower	65,000
1	Antenna, 25 gain, with deicing and lightning protection	47,500
1	RF load and wattmeter	3,700
700 ft.	6-1/8 inch transmission line (including hangers, elbows, etc.)	42,000
1	Line pressurizing equipment	1,740
Misc.	Fixed hangers, adaptors, inside fittings, hardware kits, clamps, connectors, valves, and gassing accessories	3,000
1 set	Test equipment	7,800
1	Video tape recorder with accessories	70,000
1	Vidicon film camera	50,000
1	Slide projector	3,500
1	Audio tape recorder	1,500
1	Sync generator	6,500
Misc.	Racks, monitors, and panels	6,500
	Land (25 acres)	25,000
	Building, site improvement	30,000
	Furniture and fixtures	5,000
	Installation	20,000
	Legal and engineering	10,000
	Freight and contingencies	30,000
	TOTAL:	$643,740

ESTIMATED COST OF UHF STATION
STREATOR

Quantity	Equipment	Cost
1	15-kilowatt UHF transmitter, including sideband filter, diplexer, and harmonic filters	$175,000
1 set	Spare tubes	8,000
1	Transmitter control console, including master monitor	7,000
1 set	Transmitter input and monitoring equipment	25,000
1	Guyed 600-foot antenna supporting tower	65,000
1	Antenna, 25 gain, with deicing and lightning protection	47,500
1	RF load and wattmeter	3,700
700 ft.	6-1/8 inch transmission line (including hangers, elbows, etc.)	42,000
1	Line pressurizing equipment	1,740
Misc.	Fixed hangers, adaptors, inside fittings, hardware kits, clamps, connectors, valves, and gassing accessories	3,000
1 set	Test equipment	7,800
1	Video tape recorder with accessories	70,000
1	Vidicon film camera	50,000
1	Slide projector	3,500
1	Audio tape recorder	1,500
1	Sync generator	6,500
Misc.	Racks, monitors, and panels	6,500
	Land (25 acres)	25,000
	Building, site improvement	30,000
	Furniture and fixtures	5,000
	Installation	20,000
	Legal and engineering	10,000
	Freight and contingencies	30,000
	TOTAL:	$643,740

SYSTEM DEVELOPMENT CORPORATION

EM008540

76th G. A. **1969**

SYNOPSIS: (Ch. 127, pars. 141, 149, new pars. 142p2, 144.16b, 160.3)

Amends Finance Act. Creates Communications Revolving Fund. Provides for line item appropriations and budgetary term "telecommunications". Provides expenditure from fund must be approved by Director of General Services. Transfers $ from the General Revenue Fund to the Communications Revolving Fund. Appropriates $ to Department of General Services.

LRB 1374

Fiscal Note Act
may be applicable

INTRODUCED ____________________, 1969, by

A BILL FOR

AN ACT to add Sections 6p-2, 8.16b and 24.3 to and to amend Sections 5 and 13 of "An Act in relation to State finance", approved June 10, 1919, as amended, and to transfer funds and make an appropriation in connection therewith.

Be it enacted by the People of the State of Illinois, represented in the General Assembly:

Section 1. Sections 5 and 13 of "An Act in relation to State finance", approved June 10, 1919, as amended, is amended, and Sections 6p2, 8.16b and 24.3 are added thereto, the added and amended Sections to read as follows:

Sec. 5. The following are special funds in the State Treasury:

The Agricultural Premium fund;
The Bank and Trust Company Fund;
The Board of Governors of State Colleges and Universities Income Fund;
The Board of Regents Income Fund;
The common school fund;
The Communications Revolving Fund;
The Drivers Education Fund;
The Air Transportation Revolving Fund;
The Manpower Development and Training Revolving Fund;
Federal aid road fund;
The fire prevention fund;
The Fair and Exposition fund;
The Fair and Exposition Authority Reconstruction Fund;
The Department of Personnel Training Revolving Fund;
The Game and fish fund;
The grade crossing protection fund;
The Highway Safety Fund;
The Illinois Compensation Fund;
The Illinois Fund for Illinois Colts;

The Illinois Veterans' Rehabilitation Fund;
The Mental Health Fund;
The Motor Fuel Tax fund;
The paper and printing revolving fund;
The office supplies revolving fund;
The Public Building Fund;
The Public Utility Fund;
The Public Welfare Building Fund
The Public Welfare Building Bond Retirement and Interest Fund;
The Natural Resources Development Bond Retirement and Interest Fund;
The Natural Resources Development Fund;
The road fund;
The Service Recognition Bond, Interest and Retirement Fund;
The soldiers compensation fund;
The State Boating Act Fund;
The State Housing Fund;
The State Parks Fund;
The Southern Illinois University income fund;
The State bond road fund;
The State Forest and Nurseries fund;
The State garage revolving fund;
The State Pensions Fund;
The Statistical Services Revolving Fund;
The United States Veteran's Bureau fund;
The University Income Fund;
The Universities Building Fund;
The Universities Building Bond Retirement and Interest Fund;
The welfare fund;
The working capital revolving fund;
The Local Governmental Law Enforcement Officers Fund.

When any special fund in the State Treasury is discontinued by an Act of the General Assembly, any balance remaining therein on the effective date of such Act shall be transferred to the General Revenue Fund, or to such other fund as such Act shall provide. Warrants outstanding against such discontinued fund at the time of the transfer of any such balance therein shall be paid out of the fund to which the transfer was made.

Sec. 6p-2. The Communications Revolving Fund shall be initially financed by a transfer of funds from the General Revenue Fund. Thereafter, all fees and other monies received by the Department of General Services in payment for telecommunications services rendered pursuant to Section 67.17 of the Civil Administrative Code of Illinois shall be paid into the Communications Revolving Fund. The money in this fund shall be used by the Department of General Services as reimbursement for expenditures incurred in relation to telecommunications services.

Sec. 8.16b. Appropriations for expenses related to telecommunications services for state agencies subject to Section 67.17 of the Civil Administrative Code of Illinois are payable from the Communications Revolving Fund. However, no contract shall be entered into or obligation incurred for any expenditure from the Communications Revolving Fund until after the purpose and amount has been approved in writing by the Director of General Services.

Sec. 13. The objects and purposes for which appropriations are made are classified and standardized by items as follows:

(1) Personal services;
(2) Contractual services;
(3) Travel;
(4) Commodities;
(5) Equipment;
(6) Permanent improvements;

(7) Land;

(8) Electronic Date Processing;

(9) Operation of automotive equipment;

(10) Telecommunications services;

(11) ~~(10)~~ Contingencies;

(12) ~~(11)~~ Reserve.

When an appropriation is made to an officer, department, institution, board, commission or other agency, or to a private association or corporation, in one or more of the items above specified, such appropriation shall be construed in accordance with the definitions and limitations specifed in this Act, unless the appropriation act otherwise provides.

An appropriation for a purpose other than one specified and defined in this Act may be made only as an additional, separate and distinct item, specifically stating the object and purpose thereof.

Sec. 24.3. The item "telecommunication services", when used in an appropriation act, means and includes all expenditures incurred for the lease, rental or purchase of telecommunications equipment, supplies or services and space therefor, and personal services needed for the maintenance but not for the operation thereof. Telecommunications equipment includes telephone, teletype, teletypewriter-computer and other voice, data or video systems, except those used directly in educational television.

Section 2. Within 30 days after the effective date of this Act, the Auditor of Public Accounts and the Treasurer of the State of Illinois shall transfer the sum of $ from the General Revenue Fund to the Communications Revolving Fund created by this Act.

Section 3. The sum of $, or so much thereof as may be necessary, is appropriated from the Communications Revolving Fund to the Department of General Services to carry out the purposes of this Act.

DRAFT No. 2

April 11, 1969

A BILL

Providing for the growth and development of noncommercial educational radio and television and other forms of educational telecommunications; creating the Illinois Commission for Public Telecommunications as an independent commission and defining its powers and duties, and making an appropriation in connection therewith.

SECTION I

WHEREAS, it is in the public interest of the State of Illinois to encourage and develop the growth of noncommercial radio and television broadcasting and other forms of educational telecommunications, including the media for instructional purposes, and

WHEREAS, the expansion and development of noncommercial educational radio and television and other forms of educational telecommunications and their programming depend on freedom, imagination and initiative, and

WHEREAS, it furthers the general welfare to encourage such programming which will be responsive to the interests of people throughout the State of Illinois and which will constitute an expression of diversity and excellence, and

WHEREAS, it is necessary and appropriate for the State government to complement, assist and support a policy that will most effectively make noncommercial educational radio and television and other forms of educational telecommunications service available to the people of the State of Illinois, and

WHEREAS, an independent commission should be created to facilitate the development of educational radio and television and other forms of educational telecommunications and to afford maximum protection from extraneous interference and control.

SECTION 2

There is hereby created the Illinois Public Telecommunications Commission, hereinafter referred to as "commission," as a state-chartered and state and public supported, autonomous instrumentality, charged with the responsibility for developing and administering a system of public educational telecommunications in the State of Illinois. (Definition: public educational telecommunications referred to herein means non-commercial radio and television broadcasting, and such other forms of educational technology which require electronic transmission as may be utilized by the state's public schools, colleges and universities).

SECTION 3

The commission shall be governed by a board of commissioners composed of some nine (9) Illinois citizens nominated by the Governor and confirmed by the senate, who would serve for six-year terms. In addition, the following ex officio members shall have full voting powers: The Superintendent of Public Instruction; Chairman of the Board of Trustees of the University of Illinois; Chairman of the Board of Trustees of Southern Illinois University; Chairman of the Board of Higher Education; Chairman of the Board of Governors of State Colleges and Universities; Chairman of the Board of Regents of Regency Universities; Chairman of the Board of the Illinois Junior College Board; the Superintendent of the Chicago Public Schools; the Superintendent of the Dioscean Schools(Roman Catholic) of Chicago; Chairman of the Board of the Illinois Association of Private Schools Chairman of the Board of the Illinois Association of Private Colleges and Universities; Presdient of the Illinois Senate; Speaker of the Illinois House of Representatives; the Attorney General; the State Treasurer; Chairman of the Illinois Arts Council; Chairman of the Board or his representative of Chicago Educational Television Association; and the Chairman of Chicago Area School Television(CAST). The citizen members(nominated by the Governor) should provide a representation of various talents and experience appropriate to the functions and responsibilities of the commission, and selection of members should be made on a nonpolitical and nonpartisan basis. Initially, commission members should be appointed for two, four and six year terms to provide for staggered terms of office. The Govenor should designate one member as chairman, thereafter, the commissioners would annually elect one of their members as chairman. The Commission shall conduct public meetings quarterly at which 25% of the commissioners attending shall constitute a quorum. Upon request by four (4) or more of the commissioners, the chairman shall schedule additional meetings of the commission. The commission shall furnish an annual report of its activities and accomplishments to the Legislature and the Governor. Members of the commission shall serve without compensation for their services, but are entitled to reimbursement for actual expenses incurred while performing their duties as board members.

SECTION 4

The commissioners shall appoint a full time chief executive officer charged with the customary responsibilities of the chief officer of a nonprofit corporation and such other officers as are necessary to carry out the purposes of the commission. Because of the unique nature of the commission, all appointments to the staff (other than clerical) should be made without regard to State civil service requirements. No political test or qualification should be used in selecting, appointing, promoting, or taking other personnel actions with respect to professional and nonprofessional staff of the commission.

SECTION 5

In light of the nonprofit and nonpolitcal aspects of the commission, the commission shall have no power to issue stock or declare or pay any dividends, and no part of the income or assets of the commission should inure to the benefit of an officer, director, employee, or any other individual (except as may be provided as salary or reasonable compensation for services). Finally, the commission shall be prohibited from supporting or opposing any political party or candidate for public office, elective or otherwise, and from attempting to influence legislation. The commission should not, however, be precluded from promoting full discussion of public issues.

SECTION 6

With respect to the commission's activities in the field of instructional television, under no circumstances are they intended to conflict with the determination of educational policies or curriculum content which are the responsibilities of the public educational officers.

SECTION 7

The commission, when organized, shall be empowered and authorized to do the following:

(a) Establish, ~~own,~~ and operate a ~~distribution~~ system (microwave or otherwise, state-owned, leased or common carrier) which will interconnect the educational television or radio broadcasting stations, educational institutions, public schools, one or more/ non-commercial ~~public~~ broadcasting /or non-commercial ~~and public~~ telecommunications networks ~~or systems~~ and appropriate production facilities.

(b) Apply for, receive, and hold such authorizations and licenses and assignments of channels from the Federal Communications Commission (FCC) as may be necessary to conduct its operations and prepare and file and prosecute before the FCC all applications, reports, or other documents or requests for authorization of any type necessary or appropriate to achieve its authorized purposes.

(c) Provide coordination on matters relating to public broadcasting and public telecommunications among the agencies of state government, all facets of Illinois public education and individuals, associations and institutions working in these fields both within and without the state. The commission will have available personnel who, upon suitable request, will provide information and guidance on public broadcasting and telecommunications to governmental agencies, schools, individuals, etc.

(d) Determine the policies and methods ~~method~~ of interconnection to be employed within the State's public broadcasting and public telecommunications systems.

(e) Provide appropriate assistance to other agencies of the state and local and regional groups regarding public broadcasting techniques, planning, budgeting, and related issues.

(f) Advise the Governor and State Legislature on state expenditures relative to public broadcasting and equipment and facilities associated with such effort and on questions of compatibility.

(g) Receive gifts, contributions and funds from public and private sources to be expended for the purposes of the commission.

(h) Cooperate with federal agencies, for the purpose of obtaining matching and other federal funds appropriate to the purposes of the commission and to make such reports as may be required of the State.

(i) Serve as the officially designated state agency in relationship to the requirements of the Public Broadcasting Act of 1967, as amended.

(j) Establish and maintain a library and archives of educational television and radio programs and related materials and disseminate information about such programs.

(k) Contract with program production organizations, individuals, and noncommercial educational television and radio stations within and without the state to acquire programs for distribution via its facilities. Such activity should be coordinated with the educational and other users of such materials.

(l) Conduct research, demonstrations, or training in matters related to public broadcasting, directly or through contracts with appropriate agencies, organizations or individuals, or by grants to nonprofit, noncommercial organizations such as colleges, universities and noncommercial television and radio stations.

(m) Acquire through lease, purchase, or otherwise real and other property and to hold and use this property for the purposes of the commission, as authorized.

(n) Contract with the Division of Telecommunications, Department of General Services, for the construction, repair, maintenance, and operations of the ~~distribution~~ interconnection system established by the commission.

76th G. A. 1969

SYNOPSIS: (Ch. 127, pars. 37, 63b13, new pars. 6.22, 63b13.17)

Amends Civil Administrative Code. Gives Department of General Services responsibility and authority for the administration of telecommunications services for all State Agencies. Creates User Advisory Committee to advise Department in area of telecommunications. Appropriates $ to Department of General Services.

LRB 1378

Fiscal Note Act
may be applicable

INTRODUCED ______________________, 1969, by

A BILL FOR

AN ACT to add Sections 6.22 and 67.17 to and to amend Sections 37 and 67 of "The Civil Administrative Code of Illinois", approved March 7, 1917, as amended, and to make an appropriation in connection therewith.

Be it enacted by the People of the State of Illinois, represented in the General Assembly:

Section 1. Sections 37 and 67 of "The Civil Administrative Code of Illinois", approved March 7, 1917, as amended, are amended and Sections 6.22 and 67.17 are added thereto, the added and amended Sections to read as follows:

Sec. 6.22. In the Department of General Services. A User Advisory Committee to assist and advise the Department in the area of telecommunication. This committee shall consist of the Director of General Services, or a deputy designated by him, as chairman and a representative of each State agency whose telecommunications services are subject to administration by the Department, such representative to be appointed by the principal executive officer of each such agency. Members shall receive no compensation but their expenses necessarily incurred in the performance of their duties as members shall be reimbursed by their respective agencies.

Sec. 37. In the preparation of the State budget for the 75th and all subsequent biennia, the Director of Finance shall, not later than the 15th day of September in the year preceding the convening of the General Assembly, distribute to all departments and to all offices and institutions of the State government (including the elective officers in the executive department and including the University of Illinois and the judicial department) the proper blanks necessary to the preparation of budget estimates, which blanks shall be in such form as shall be prescribed by the Director of Finance, to procure, among other things, information as to the revenues and expenditures for the two preceding fiscal years, the appropriations made by the previous General Assembly, the expenditures therefrom, encumbrances thereon, and the amounts unencumbered and unexpended, an estimate of the revenues and expenditures of the current fiscal year, and an estimate of the revenues and amounts needed for the respective departments and offices for the two years next succeeding beginning at the expiration of the first fiscal quarter after the adjournment of the General Assembly. Each department, office and institution (including the elective officers in the executive and judicial departments and including the University of Illinois) shall, not later than the 15th day of November, file in the office of the Director of Finance its estimate of receipts and expenditures for the succeeding biennium. Such estimates shall be accompanied by a statement in writing giving facts and explanation of reasons for each item of expenditure requested. The Director of Finance may, in his discretion, make further inquiries and investigations as to any item desired. He may approve, disapprove or alter the estimates. He shall, on or before the first day of January preceding the convening of the General Assembly, submit to the Governor in writing his estimates of revenues and appropriations for the next succeeding biennium.

All statements and estimates of expenditures submitted to the Director of Finance in connection with the preparation of a State budget, and any other estimates of expenditures, supporting requests for appropriations, shall be formulated according to the various functions and activities for which the respective department, office or institution of the state government (including the elective officers in the executive department and including the University of Illinois and the judicial department) is responsible. All such statements and estimates of expenditures relating to a particular function or activity shall be further formulated or subject to analysis in accordance with the following classification of objects:

(1) Personal services
(2) Contractual services
(3) Travel
(4) Commodities
(5) Equipment
(6) Permanent improvements
(7) Land
(8) Electronic Data Processing
(9) Telecommunication services
(10) ~~(9)~~ Interest
(11) ~~(10)~~ Awards and grants
(12) ~~(11)~~ Debt retirement
(13) ~~(12)~~ Non-Cost charges

The foregoing items numbered (1) to (7) inclusive, when so used, shall be defined as provided by sections 14 to 22 inclusive of "An Act in relation to State Finance", approved June 10, 1919, as amended.

The item "electronic data processing" means, and when used in connection with a State budget or expenditure statement or estimate, shall include expenditures incurred for the lease, rental or purchase of electronic data processing equipment and related devices, supplies, materials, services and space therefor, and personal services needed.

The item "telecommunications services" means, and when used in connection with a State budget or expenditure statement or estimate, shall include expenditures incurred for the lease, rental or purchase of telecommunications equipment, supplies or services and space therefor and personal services needed for the maintenance thereof but not for the operation thereof. Telecommunications equipment includes telephone, teletype, teletypewriter-computer and other voice, data or video systems, except those used directly in educational television.

The item "interest" means, and when used in connection with a State budget or expenditure statement or estimate, shall include interest charges on State borrowings.

The item "awards and grants" means, and when used in connection with a State budget or expenditure statement or estimate, shall include payments for: Awards and indemnities, pensions and annuities (other than amounts payable for personal services as herein defined); shared revenue payments or grants to local governments or to quasi-pubic agencies; and gratuitous payments to, or charges incurred for the direct benefit of, natural persons who are not wards of the State. Provided, however, that payments to any local government as reimbursement for costs incurred by it in performing an activity for which it is specifically by statute made an agent of the State shall be chargeable to and classified under the same item or account as though such costs were incurred directly by the State.

The item "debt retirement" means, and when used in connection with a State budget or expenditure statement or estimate shall include payments for the retirement of State borrowings.

The item "non-cost charges" means, and when used in connection with a State budget or expenditure statement or estimate shall include, charges incurred for the refund of taxes and deposits and any charges against an appropriation, other than for payments to a revolving fund of the State from another State fund, which do not diminish the aggregate total of funds and money of the State. All statements and estimates of expenditures submitted to the Director of Finance in connection with the preparation of a State budget, and any other estimates of expenditures supporting requests for appropriations, shall be accompanied by comparative performance data formulated according to the various functions and activities, and, whenever the nature of the work admits, according to the work units, for which the respective department, officer or institution of the State government (including the elective officers in the executive department and including the University of Illinois and the judicial department) is responsible. All such statements and estimates of expenditures shall be accompanied, in addition, by a tabulation of all position and employment titles in such department, office or institution, the number of each, and the salaries for each, formulated according to divisions, bureaus, sections, offices, departments, boards, and similar subdivisions, which shall correspond as nearly as practicable to the functions and activities for which the department, office or institution is responsible.

Sec. 67. The Department of General Services is responsible for certain State properties, acquisitions and services. In performing this responsibility the Department has the powers and duties set forth in Sections 67.01 through 67.17 ~~67.14~~.

Sec. 67.17. To provide for and co-ordinate telecommunications services for all State agencies. For this purpose the Department shall have the power and duty to:

(a) Provide for and control the procurement, retention, installation and maintenance of telecommunications equipment or services used by State agencies in the interest of effeciency and economy;

(b) Establish standards for communications services for State agencies;

(c) Establish charges for communication services for for State agencies. State agencies charged for such services shall reimburse the Department of General Services by vouchers drawn against their respective appropriations for telecommunications services;

(d) Instruct all State agencies to report their usage of telecommunication services regularly to the Department in such manner as the Director may prescribe;

(e) Analyze the present and future aims and needs of all State agencies in the area of telecommunications services and plan to serve such aims and needs in the most effective and efficient manner; and

(f) Establish such administrative organization within the Department as is required to accomplish the purpose of this Section.

However, the Department may not control or interfere with the actual use or operation of telecommunications systems by the several State agencies and the Department shall have no authority or responsibility in connection with education television as such.

Section 2. The sum of $, or so much thereof as may be necessary, is appropriated to the Department of General Services to carry out the purposes of this Act.

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